JAPANESE [JP,2000-031944,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

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CLAIMS

[Claim(s)]
[Claim 1] The sending set which carries out [providing a transmission-control means accumulates a coding means distribute a sending signal to two or more hierarchies in a cel unit, and perform coding for error detection for every hierarchy, and the encoded cel, outputs a new cel when there is no resending demand, and re-output the cel concerned when there is a resending demand, and a hierarchy modulation means perform a hierarchy modulation to the cel outputted from this transmission-control means, and] as the description.
[Claim 2] A transmission-control means is a sending set according to claim 1 characterized by providing the 1st buffer which accumulates the encoded cel, the hierarchy control means which controls the hierarchy of the cel written in the 1st buffer, and the 2nd buffer which accumulates the cel controlled by this hierarchy control means for every hierarchy.
[Claim 3] A hierarchy control means is a sending set according to claim 2 characterized by re-outputting a cel with a resending demand on a different hierarchy from last time.
[Claim 4] A hierarchy modulation means is a sending set according to claim 1 to 3 characterized by providing a diffusion means to diffuse with a different sign for every hierarchy, and to output with a different transmission level, an addition means to add the output of this diffusion means, and a modulation means to modulate the output of this addition means.
[Claim 5] A diffusion means is a sending set according to claim 4 characterized by being spread with the sign of a different diffusion coefficient for every hierarchy, and outputting to different timing.
[Claim 6] A hierarchy modulation means is a sending set according to claim 1 to 3 characterized by providing a carrier modulation means to modulate on a different frequency for every hierarchy, and to output with a different transmission level, and an addition means to add the output of this carrier modulation means.
[Claim 7] A carrier modulation means is a sending set according to claim 6 characterized by becoming irregular so that each frequency may have orthogonality relation.
[Claim 8] A hierarchy modulation means is a sending set according to claim 1 to 3 characterized by providing a mapping means to perform different mapping processing for every hierarchy, and to output it to different timing, an addition means to add the output of this mapping means, and a modulation means to modulate the output of this addition means.
[Claim 9] The receiving set characterized by providing the hierarchy recovery means which restores to the signal by which the hierarchy modulation was carried out in a transmitting side, and takes out each hierarchy's cel, an error detection means to perform error detection of a cel for every hierarchy, and a resending demand transmitting means to transmit the resending demand signal about the cel which detected the error.
[Claim 10] A hierarchy recovery means is a receiving set according to claim 9 which carries out the back diffusion of electrons with the same sign as the diffusion process of a transmitting side, and is characterized by providing the back-diffusion-of-electrons means which takes out each hierarchy's cel, and the RAKE composition means which carries out RAKE composition of each hierarchy's cel.
[Claim 11] A hierarchy recovery means is a receiving set according to claim 9 characterized by

providing the recovery means which gets over on the same frequency as modulation processing of a transmitting side, and takes out each hierarchy's cel.
[Claim 12] A hierarchy recovery means is a receiving set according to claim 9 characterized by providing the recovery means which gets over to the same timing as mapping processing of a transmitting side, and takes out each hierarchy's cel.
[Claim 13] The communication terminal characterized by carrying a sending set according to claim 1 to 8, and performing radio.
[Claim 14] Base station equipment characterized by carrying a receiving set according to claim 9 to 12, and performing the communication terminal and radio of claim written 13 publication.
[Claim 15] Base station equipment characterized by carrying a sending set according to claim 1 to 8, and performing radio.
[Claim 16] The communication terminal characterized by carrying a receiving set according to claim 9 to 12, and performing base station equipment according to claim 15 and radio.
[Claim 17] The radio communications system characterized by performing radio with a communication terminal according to claim 13 and base station equipment according to claim 14.

[Claim 18] The radio communications system characterized by performing radio with a communication terminal according to claim 16 and base station equipment according to claim 15.

[Claim 19] The data transmission approach which distributes a sending signal to two or more hierarchies in a cel unit in a transmitting side, performs coding for error detection for every hierarchy, and is characterized by performing a hierarchy modulation to the encoded cel, restoring to the signal by which the hierarchy modulation was carried out, taking out each hierarchy's cel, and performing error detection of a cel for every hierarchy in a receiving side.
[Claim 20] The data transmission approach according to claim 19 which transmits the resending demand signal about the cel which detected the error in the receiving side, and is characterized by outputting a new cel when there is no resending demand, and re-outputting the cel concerned when there is a resending demand in a transmitting side.
[Claim 21] The data transmission approach according to claim 19 or 20 characterized by re-outputting a cel with a resending demand on a different hierarchy from last time.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is carried in a radio communication equipment, and relates to a receiving set and the data transmission approach at the sending set list to which a data transmission rate is changed according to a circuit situation.
[0002]
[Description of the Prior Art] In a radio communications system, according to a circuit situation, a data transmission rate may be controlled accommodative, and the data transmission approach which raises the average transmission efficiency of data may be adopted.
[0003] Hereafter, the radio communication equipment which carries out adaptive control of the conventional data transmission rate is explained using a drawing.
[0004] Drawing 10 is the block diagram showing the configuration of the radio communication equipment in the conventional TDD transmission system. Drawing 10 (a) is the block diagram showing the configuration of the side (henceforth a "transmitting side") which carries out adaptive control of the data transmission rate, and transmits data, and drawing 10 (b) is the block diagram showing the configuration of the side (henceforth a "receiving side") which receives the data by which adaptive control was carried out in the data transmission rate.
[0005] The transmitting side of the radio communication equipment shown in drawing 10 (a) The data buffer 1 which stores a sending signal temporarily, and the modulator 2 which performs a BPSK modulation to a sending signal, The modulator 3 which performs a QPSK modulation to a sending signal, and the modulator 4 which performs 16 AM to a sending signal, The amplifier 5 which amplifies the modulated signal, and the antenna 6 which carries out the wireless transmission and reception of the signal, The level measuring instrument 7 which measures the level of the signal received from the antenna 6, A data transmission rate is chosen from a received signal level, and it mainly consists of a rate selector 8 which generates the rate selection information which shows a data transmission rate, and switches 9 and 10 which change by the rate selector 8 and are controlled.
[0006] Moreover, the receiving side of the radio communication equipment shown in drawing 10 (b) The antenna 21 which carries out the wireless transmission and reception of the signal, and the amplifier 22 which amplifies an input signal, The demodulator 23 which performs a BPSK recovery to an input signal, and the demodulator 24 which performs a QPSK recovery to an input signal, The demodulator 25 which performs a 16QAM recovery to an input signal, and the data buffer 26 which stores the signal to which it restored, It mainly consists of switches 29 and 30 which change with the BPSK demodulator 27 which carries out the BPSK recovery of the input signal, and extracts rate selection information, the rate detector 28 which detects a data transmission rate from the output of the BPSK demodulator 27, and the rate detector 28, and are controlled.
[0007] By getting down with an uphill circuit in the case of a TDD transmission system, since the propagation path of a circuit is the same, the level of an input signal can be measured in a transmitting side, and the modulation technique of a sending signal can be chosen based on the level of the input signal.

[0008] The rate selector 8 of a transmitting side chooses modulation techniques, such as 16QAM with a high data transmission rate, and controls switches 9 and 10, when the level of an input signal is large, it judges that a circuit situation is good, an error and a cone judge it that a circuit situation is bad, when level is low, and although a data transmission rate is low, it chooses modulation techniques, such as a pile BPSK, as an error, and controls switches 9 and 10. Furthermore, the rate selector 8 stores rate selection information in a data buffer 1.
[0009] The sending signal stored in the data buffer 1 is modulated by the modulation technique chosen by the rate selector 8. However, rate selection information is always modulated by the BPSK method, in order to make an error hard to produce. After the modulated signal is amplified with amplifier 5, wireless transmission of it is carried out from an antenna 6.
[0010] After the signal received by the antenna 21 of a receiving side is amplified with amplifier 22, rate selection information is extracted by the BPSK demodulator 27, and a data transmission rate is detected by the rate detector 28. And based on the detected data transmission rate, change control is carried out and switches 29 and 30 restore to an input signal by the recovery method of the same data transmission rate as a modulation technique. A recovery result is taken out as an input signal, after being stored in a data buffer 26.
[0011] Drawing 11 is the block diagram showing the configuration of the radio communication equipment in the conventional FDD transmission system. Drawing 11 (a) shows the configuration of a transmitting side, and drawing 11 (b) shows the configuration of a receiving side. In addition, in drawing 11 , about the same component as drawing 10 , the same sign as drawing 10 is attached and explanation is omitted.
[0012] Since in the case of a FDD transmission system it gets down with an uphill circuit and the propagation paths of a circuit differ, in a receiving side, the level of an input signal is measured and the modulation technique of a sending signal is chosen based on the level of an input signal.
[0013] The transmitting side of the radio communication equipment shown in drawing 11 as compared with drawing 10 possesses the amplifier 11 which amplifies an input signal, the demodulator 12 which extracts rate selection information from an input signal, and the rate detector 13 which detects a data transmission rate from rate selection information instead of the level measuring instrument 7 and the rate selector 8.
[0014] Moreover, a receiving side possesses the level measuring instrument 31 which measures a received signal level, the rate selector 32 which generates the rate selection information which chooses a data transmission rate from receiving level, and shows a data transmission rate, the modulator 33 which modulates rate selection information, and the amplifier 34 which amplifies the modulated rate selection information instead of the BPSK demodulator 27 and the rate selector 28.
[0015] The rate selector 32 of a receiving side judges that a circuit situation is good, when the level of an input signal is large, and an error and a cone choose modulation techniques, such as 16QAM with a high data transmission rate, and it outputs rate selection information to a modulator 33. Moreover, the rate selector 32 judges that a circuit situation is inferior, when the level of an input signal is small, although a data transmission rate is low, it chooses modulation techniques, such as a pile BPSK, as an error, and it outputs rate selection information to a modulator 33. After becoming irregular by the BPSK method which is a modulation technique which an error cannot produce easily and amplifying rate selection information with amplifier 34 with a modulator 33, it is transmitted to a transmitting side from an antenna 21.
[0016] Moreover, the rate selector 32 makes the preparations which control switches 29 and 30 and perform the recovery corresponding to the specified data transmission rate at the same time it outputs rate selection information. A recovery result is taken out as an input signal, after being stored in a data buffer 26.
[0017] After the signal received by the antenna 6 of a transmitting side is amplified with amplifier 11, it gets over with a demodulator 12 and rate selection information is extracted. And a data transmission rate is detected from rate selection information, switches 9 and 10 are controlled by the rate detector 13, and the data transmission rate of a sending signal is determined with it.
[0018] It is once stored in a data buffer 1, and becomes irregular according to control of the rate

detector 13 with the BPSK modulator 2, the QPSK modulator 3, or the 16QAM modulator 4, and after a sending signal is amplified with amplifier 5, it is transmitted to a receiving side from an antenna 6.

[0019] Thus, the average transmission efficiency of data is raised by the radio communication equipment which carries out adaptive control of the conventional data transmission rate raising transmission efficiency using a modulation technique with a high data transmission rate, when a circuit situation is good, and making data transmit to an error certainly using a pile modulation technique, when a circuit situation is inferior, although a data transmission rate is low.

[0020]

[Problem(s) to be Solved by the Invention] However, the above-mentioned conventional radio communication equipment has the technical problem that transmission efficiency will fall on the contrary, when rate selection information must be delivered by the transmitting side and the receiving side and rate selection information is mistaken. Moreover, when multi-pass phasing happens, it has the technical problem that just receiving level is inadequate and the presumed precision of receiving quality worsens as a decision ingredient of a circuit situation. Furthermore, since the circuit situation at the rate selection and signal transmitting time changes when a phasing rate is quick, it has the technical problem that transmission efficiency cannot fully be improved.

[0021] This invention aims at providing with a receiving set and the data transmission approach the sending set list which changes a data transmission rate automatically in accordance with a circuit situation, without being made in view of this point and delivering rate selection information.

[0022]

[Means for Solving the Problem] A means to restore to an input signal in a receiving side by this invention's performing coding processing which distributes a sending signal to two or more hierarchies in a cel unit in a transmitting side, and can carry out error detection for every hierarchy, carrying out a hierarchy modulation, and transmitting in order to solve the above-mentioned technical problem, to have performed error detection for every hierarchy, and to perform a resending demand for every hierarchy was provided.

[0023]

[Embodiment of the Invention] Invention of the sending set in the 1st mode of this invention A coding means to distribute a sending signal to two or more hierarchies in a cel unit, and to perform coding for error detection for every hierarchy, The configuration possessing a transmission-control means to accumulate the encoded cel, to output a new cel when there is no resending demand, and to re-output the cel concerned when there is a resending demand, and a hierarchy modulation means to perform a hierarchy modulation to the cel outputted from this transmission-control means is taken.

[0024] moreover, the 9th voice of this invention -- invention of the receiving set which can be set like restores to the signal by which the hierarchy modulation was carried out in a transmitting side, and takes the configuration possessing the hierarchy recovery means which takes out each hierarchy's cel, an error detection means perform error detection of a cel for every hierarchy, and a resending demand transmitting means transmit the resending demand signal about the cel which detected the error.

[0025] moreover, the 19th voice of this invention -- invention of the data-transmission approach which can be set like distributes a sending signal to two or more hierarchies in a cel unit in a transmitting side, performs coding for error detection for every hierarchy, it performs a hierarchy modulation to the encoded cel, restores to the signal by which the hierarchy modulation was carried out in a receiving side, takes out each hierarchy's cel, and takes the approach of performing error detection of a cel for every hierarchy.

[0026] Moreover, in the data transmission approach in the 19th mode, invention in the 20th mode of this invention transmits the resending demand signal about the cel which detected the error in the receiving side, when there is no resending demand at a transmitting side, it outputs a new cel, and when there is a resending demand, it takes the approach of re-outputting the cel concerned.

[0027] Here, a hierarchy modulation is a method which distinguishes between the quality of two or more signals transmitted by the same circuit, and is modulated by the device of signal point arrangement etc.
[0028] By these configurations, in a transmitting side, a sending signal is distributed to two or more hierarchies in a cel unit, coding processing whose error detection is possible for every hierarchy is performed, a hierarchy modulation is performed, and according to a circuit situation, the adaptive control of the data transmission rate can be carried out automatically at a receiving side, without being able to perform error detection for every hierarchy and delivering rate selection information.
[0029] moreover, the 2nd voice of this invention -- invention which can be set like -- the 1st voice -- in the sending set which can be set like, a transmission-control means takes the configuration possessing the 1st buffer which accumulates the encoded cel, the hierarchy control means which controls the hierarchy of the cel written in the 1st buffer, and the 2nd buffer which accumulates the cel controlled by this hierarchy control means for every hierarchy.
[0030] Moreover, invention in the 3rd mode of this invention takes the configuration which re-outputs the cel in which the hierarchy control means had a resending demand on a different hierarchy from last time in the sending set in the 2nd mode.
[0031] Moreover, invention in the 21st mode of this invention takes the approach of re-outputting a cel with a resending demand on a different hierarchy from last time in the data transmission approach of the 19th mode or the 20th mode.
[0032] By these configurations, if resending is repeated even when a condition with an inferior circuit continues for a long time in order to transmit on the last hierarchy and a different hierarchy at the time of resending, a cel can be transmitted on a hierarchy with the automatic highest quality, the probability of re-resending is reduced, and a cel waste ratio can be reduced.
[0033] moreover, the 4th voice of this invention -- invention which can set like -- the 1st mode thru/or the 3rd voice -- in one of sending sets [like], a hierarchy modulation means takes the configuration possessing a diffusion means diffuses with a different sign for every hierarchy, and output with a different transmission level, an addition means add the output of this diffusion means, and a modulation means modulate the output of this addition means.
[0034] Moreover, invention in the 5th mode of this invention takes the configuration which diffuses a diffusion means with the sign of a different diffusion coefficient for every hierarchy, and is outputted to different timing in the sending set of the 4th mode.
[0035] moreover, the 10th voice of this invention -- invention which can be set like -- the 9th voice -- in a receiving sending set [like], the back diffusion of electrons of the hierarchy recovery means is carried out with the same sign as the diffusion process of a transmitting side, and it takes the configuration possessing the back-diffusion-of-electrons means which takes out each hierarchy's cel, and the RAKE composition means which carries out RAKE composition of each hierarchy's cel.
[0036] By these configurations, a data transmission rate can be automatically changed in accordance with a circuit situation in the radio communications system of a CDMA method, without delivering rate selection information between a transmitting side and a receiving side.
[0037] moreover, the 6th voice of this invention -- invention which can be set like -- the 1st mode thru/or the 3rd voice -- in one of sending sets [like], a hierarchy modulation means takes the configuration possessing a carrier modulation means to modulate on a different frequency for every hierarchy, and to output with a different transmission level, and an addition means to add the output of this carrier modulation means.
[0038] moreover, the 11th voice of this invention -- invention which can be set like -- the 9th voice -- in a receiving sending set [like], it gets over on the same frequency as modulation processing of a transmitting side, and a hierarchy recovery means takes the configuration possessing the recovery means which takes out each hierarchy's cel.
[0039] By these configurations, a data transmission rate can be automatically changed in accordance with a circuit situation in the radio communications system of a multi-carrier method, without delivering rate selection information between a transmitting side and a receiving side.

[0040] Moreover, the configuration in which, as for invention in the 7th mode of this invention, each frequency modulates a carrier modulation means in the sending set of the 6th mode so that it may have orthogonality relation is taken.
[0041] By this configuration, a data transmission rate can be automatically changed in accordance with a circuit situation in the radio communications system using OFDM which is a kind of a multi-carrier method, without delivering rate selection information between a transmitting side and a receiving side.
[0042] moreover, the 8th voice of this invention -- invention which can set like -- the 1st mode thru/or the 3rd voice -- in one of sending sets [like], a hierarchy modulation means takes the configuration possessing a mapping means performs different mapping processing for every hierarchy, and output it to different timing, an addition means add the output of this mapping means, and a modulation means modulate the output of this addition means.
[0043] moreover, the 12th voice of this invention -- invention which can be set like -- the 9th voice -- in a receiving sending set [like], it gets over to the same timing as mapping processing of a transmitting side, and a hierarchy recovery means takes the configuration possessing the recovery means which takes out each hierarchy's cel.
[0044] By these configurations, a data transmission rate can be automatically changed in accordance with a circuit situation in the radio communication equipment of a TDMA method, without delivering rate selection information between a transmitting side and a receiving side.
[0045] Moreover, invention of the communication terminal in the 13th mode of this invention takes the configuration which carries a sending set according to claim 1 to 8, and performs radio. In addition, the mobile station equipment in migration communication system is included in a communication terminal.
[0046] Moreover, invention of the base station equipment in the 14th mode of this invention carries a receiving set according to claim 9 to 12, and takes the configuration which performs the communication terminal and radio of claim written 13 publication.
[0047] Moreover, invention of the base station equipment in the 15th mode of this invention takes the configuration which carries a sending set according to claim 1 to 8, and performs radio.

[0048] Moreover, invention of the communication terminal in the 16th mode of this invention carries a receiving set according to claim 9 to 12, and takes the configuration which performs base station equipment according to claim 15 and radio.
[0049] Moreover, invention of the radio communications system in the 17th mode of this invention takes the configuration which performs radio with a communication terminal according to claim 13 and base station equipment according to claim 14.
[0050] Moreover, invention of the radio communications system in the 18th mode of this invention takes the configuration which performs radio with a communication terminal according to claim 16 and base station equipment according to claim 15.
[0051] Hereafter, the gestalt of operation of this invention is explained to a detail with reference to an accompanying drawing.
(Gestalt 1 of operation) Drawing 1 is the block diagram showing the configuration of the radio communication equipment in the gestalt 1 of operation of this invention. The side (henceforth a "transmitting side") which drawing 1 (a) carries out the hierarchy modulation of the data, and transmits is shown, and drawing 1 (b) shows the side (henceforth a "receiving side") which receives the data by which the hierarchy modulation was carried out.
[0052] The encoder 101 with which the transmitting side of the radio communication equipment shown in drawing 1 (a) performs coding for error detection to a sending signal, The data buffer 102 which stores the encoded sending signal temporarily, It mainly consists of the hierarchy modulator 103 which performs a hierarchy modulation to the encoded signal, the amplifier 104 which amplifies the signal by which the hierarchy modulation was carried out, an antenna 105 which transmit and receive a signal, amplifier 106 which amplifies the resending demand signal from a receiving side, and a demodulator 107 which restores to a resending demand signal.
[0053] The receiving side shown in drawing 1 (b) mainly consists of the antenna 151 which transmits and receives a signal, the amplifier 152 which amplifies an input signal, the hierarchy

demodulator 153 which performs a hierarchy recovery to the amplified input signal, the error-detection machines 154 and 155 which detect the error of an input signal, a data buffer 157 which stores an input signal temporarily, a modulator 158 which modulates a resending demand signal, and amplifier 159 which amplifies a resending demand signal.
[0054] The encoder 101 of a transmitting side distributes a sending signal to two or more hierarchies in a cel unit, it encodes so that error detection may be possible for every hierarchy, and it is stored in a data buffer 102. A hierarchy modulation is carried out with the hierarchy modulator 103, and the cel which was able to be distributed to each hierarchy is amplified with amplifier 104, and is transmitted from an antenna 105.
[0055] Hereafter, a hierarchy modulation is explained using drawing showing signal point arrangement of the QPSK modulation shown in drawing 2 . Drawing 2 (a) shows signal point arrangement of the usual QPSK modulation, and since the distance-201 between the signal points of I component and the distance 202 between the signal points of Q component are equal, it is the same as that of the quality of Q component. [of the quality of I component] Drawing 2 (b) shows signal point arrangement of the QPSK modulation which performed hierarchy modulation processing, and since the distance 251 between signal points of I component is longer than the distance 252 between signal points of Q component, its quality of I component is better than the quality of Q component. Moreover, although the quality of Q component is bad to drawing 2 (a), the quality of drawing 2 (b) of I component is good.
[0056] The signal received with the antenna 151 is amplified with amplifier 152, a hierarchy recovery is carried out with the hierarchy demodulator 153, and each hierarchy's cel is taken out. Error detection processing of the cel by which the hierarchy modulation was carried out is carried out for every hierarchy with the error detection vessels 154 and 155, and the resending demand signal about the cel in which the error was detected is outputted. It becomes irregular with a modulator 158, and a resending demand signal is amplified with amplifier 159, and is transmitted from an antenna 151.
[0057] Via an antenna 105 and an amplifier 106, the resending demand signal transmitted from the receiving side is detected by the demodulator 107, and is outputted to a data buffer 102. And the cel with a resending demand is automatically read from a data buffer 102 again, and is resent.

[0058] For example, if it considers as I component which shows the hierarchy 1 in drawing 1 to drawing 2 (b) and is Q component which shows the hierarchy 2 in drawing 1 to drawing 2 (b), even when a circuit condition is inferior, since the hierarchy 1 with high quality can succeed in data transmission, he can secure the transmission efficiency of the BPSK average which is the data transmission rate of 1 bit per one symbol. In addition, resending is repeated until the cel transmitted by the hierarchy 2 succeeds in data transmission. However, the cel concerned is discarded when a retry count exceeds buffer size.
[0059] On the other hand, since the hierarchy 2 with low quality can also succeed in data transmission in addition to a hierarchy 1 when a circuit situation is good, the transmission efficiency of the QPSK average which is the data transmission rate of 2 bits per one symbol can be acquired.
[0060] Thus, according to a circuit situation, the adaptive control of the data transmission rate can be automatically carried out in a transmitting side, without delivering rate selection information by distributing a sending signal to two or more hierarchies in a cel unit, performing coding processing whose error detection is possible for every hierarchy, performing a hierarchy modulation, and performing error detection for every hierarchy by the receiving side.
[0061] In addition, although the gestalt 1 of operation explains the case where the number of hierarchies is two, a limit does not have this invention in a hierarchy's phase, and it may use how many steps of hierarchies for it.
[0062] (Gestalt 2 of operation) Drawing 3 is the block diagram showing the configuration of the radio communication equipment in the gestalt 2 of operation. Drawing 3 (a) shows a transmitting side and drawing 3 (b) shows a receiving side. In addition, in drawing 3 , about the same component as drawing 1 , the same sign as drawing 1 is attached and explanation is omitted.
[0063] As compared with drawing 1 , the transmission-control machine 301 which controls the

hierarchy of a sending signal, and the TMP buffers 302, 303, and 304 which store a cel temporarily are added to the transmitting side of the radio communication equipment shown in drawing 3 . Moreover, although the case where the number of hierarchies is 2 is shown and drawing 3 shows the case where the number of hierarchies is 3 at drawing 1 , for explanation, there is no fundamental configuration difference by this.

[0064] The transmission-control machine 301 controls the hierarchy of each cel stored in the data buffer 102, and stores him in the TMP buffers 302, 303, and 304. Moreover, elimination processing of the cel written in a data buffer 102 and the TMP buffers 302, 303, and 304 is performed. Moreover, when a resending demand signal is inputted from a demodulator 107, it controls to transmit the cel to resend on a different hierarchy from last time by writing an applicable cel in a different TMP buffer from last time.

[0065] Next, the control action of the transmission-control machine 301 is explained using the mimetic diagram shown in the flow Fig. and drawing 5 which are shown in drawing 4 . In addition, I in drawing 4 shows the number of hierarchies. Moreover, quality is a good hierarchy, so that i is small, a hierarchy 1 is the quality and Hierarchy I considers as what has the worst quality.

[0066] First, the cel written in all the TMP buffers 302, 303, and 304 at the time of transmitting initiation is eliminated (ST401). Next, the transmitting cel inputted from the data buffer 102 is written in the vacant TMP buffers 302, 303, and 304 (ST402). In addition, a hierarchy modulation is carried out with the hierarchy modulator 103, the cel written in each TMP buffer has the amplitude amplified with amplifier 104, and wireless transmission is carried out from an antenna 105.

[0067] Completion of transmission of a transmitting cel eliminates the cel written in all the TMP buffers 302, 303, and 304 (ST404). (ST403)

[0068] Next, it judges whether there was any resending demand from a receiving side to the cel transmitted on the hierarchy 2 (ST405, ST406). And when there is a resending demand to an applicable cel by ST406, it judges whether the retry count of the cel concerned is over buffer size (ST407).

[0069] And when the retry count of an applicable cel is not over buffer size by ST407, from the hierarchy who transmitted last time, one rank is raised and it writes in a TMP buffer (ST408, ST409). Since it can transmit to an error on a pile hierarchy most automatically while repeating a resending demand by raising one rank of hierarchies of the cel to resend, and transmitting, the probability of re-resending can be reduced, a cel waste ratio can be reduced, and certainty of transmission can be made high.

[0070] Moreover, when there is no resending demand to an applicable cel at ST406, or when it is over buffer size by ST407, an applicable cel is deleted from a data buffer 102 (ST410).

[0071] And actuation of ST406 to ST410 is repeated to the cel transmitted on a hierarchy 3 to the hierarchy I (ST411, ST412, ST413).

[0072] Next, it judges whether there was any resending demand from a receiving side to the cel transmitted on the hierarchy 1 (ST414, ST406). And when there is a resending demand by ST406, it judges whether the retry count of the cel concerned is over buffer size (ST407).

[0073] And when the retry count of an applicable cel is not over buffer size by ST407, it judges whether the cel is already written in a hierarchy's 1 TMP buffer (ST408, ST415).

[0074] By ST415, when the cel is already written in a hierarchy's 1 TMP buffer, the cel concerned is written in Hierarchy's I TMP buffer (ST416).

[0075] Moreover, by ST415, when a hierarchy's 1 TMP buffer is vacant, the cel concerned is written in a hierarchy's 1 TMP buffer (ST417).

[0076] Moreover, when there is no resending demand at ST406, or when it is over buffer size by ST407, an applicable cel is deleted from a data buffer 102 (ST410).

[0077] And it judges whether the cel which is not transmitted to a data buffer 102 remains, and when the cel which be still transmitted and which is not remains, actuation of ST402 to ST417 is repeated. Moreover, data transmission is ended when transmission of all cels is completed (ST418).

[0078] Drawing 5 is a mimetic diagram showing the cel written in the TMP buffer of each hierarchy of the radio communication equipment in the gestalt 2 of operation.

[0079] First, in F501, a cel P2 is written in a cel P1 and a hierarchy 2, and a cel P3 is written in a hierarchy 1 at a hierarchy 3.
[0080] Supposing an error arises only to a hierarchy 3 in a receiving side as a result of the transmission in F501, a resending demand of a hierarchy 3 will be given to a transmitting side. In F502, a cel P3 is written in a hierarchy 2 according to a resending demand. Moreover, a new cel P4 and a new cel P5 are written in vacant hierarchy 1 and hierarchy 3.
[0081] Supposing all cels mistake by the receiving side and it is received that there is nothing as a result of the transmission in F502, a resending demand will not be given to a transmitting side. Therefore, in F503, the new cel P6, a cel P7, and a cel P8 are written in all hierarchies.
[0082] Supposing an error arises to both a hierarchy 2 and the hierarchy 3 in a receiving side as a result of the transmission in F503, a resending demand of a hierarchy 2 and a hierarchy 3 will be given to a transmitting side. In F504, according to a resending demand, a cel P7 is written in a hierarchy 1, and a cel P8 is written in a hierarchy. Moreover, a cel P9 is written in the vacant hierarchy 3.
[0083] Here, an error does not arise to a hierarchy 3 but an error may arise to the more nearly quality hierarchy 2 than a hierarchy 3. Supposing an error arises only to a hierarchy 2 in a receiving side as a result of the transmission in F504, a resending demand of a hierarchy 2 will be given to a transmitting side. In F505, a cel P8 is written in a hierarchy 1 according to a resending demand. Moreover, a new cel P10 and a new cel P11 are written in vacant hierarchy 2 and hierarchy 3.
[0084] Supposing an error arises to all the hierarchies 2 in a receiving side as a result of the transmission in F505, a resending demand of all hierarchies will be given to a transmitting side. In F506, according to a resending demand, a cel P10 is written in a hierarchy 1, a cel P11 is written in a hierarchy 2, and a cel 8 is written in a hierarchy 3.
[0085] Supposing an error arises only to a hierarchy 3 in a receiving side as a result of the transmission in F506, a resending demand of a hierarchy 3 will be given to a transmitting side. In F507, a cel P8 is written in a hierarchy 2 according to a resending demand. Moreover, a new cel P12 and a new cel P13 are written in vacant hierarchy 1 and hierarchy 3.
[0086] Supposing an error arises to a hierarchy 2 and a hierarchy 3 in a receiving side as a result of the transmission in F507, a resending demand of a hierarchy 2 and a hierarchy 3 will be given to a transmitting side. Here, since a cel P8 serves as delay exceeding buffer size, it is discarded. Therefore, in F508, a cel P13 is written in a hierarchy 2 according to a resending demand. Moreover, a new cel P14 and a new cel P15 are written in vacant hierarchy 1 and hierarchy 3.
[0087] Supposing an error arises only to a hierarchy 1 in a receiving side as a result of the transmission in F508, a resending demand of a hierarchy 1 will be given to a transmitting side. Here, since the error is not produced on a hierarchy 2, in F509, the new cel P16 and a cel P17 are again written for a cel P14 in a hierarchy 1 at writing, a hierarchy 2, and a hierarchy 3.
[0088] Supposing an error arises to a hierarchy 1 and a hierarchy 2 in a receiving side as a result of the transmission in F509, a resending demand of a hierarchy 1 and a hierarchy 2 will be given to a transmitting side. Here, since the error is produced also to the hierarchy 2 in addition to the hierarchy 1, in F510, the cel P14 which transmitted the cel P16 transmitted on the hierarchy 2 last time to the hierarchy 1 on the hierarchy 1 writing and last time is written in a hierarchy 3. Moreover, the new cel P18 is written in the vacant hierarchy 2.
[0089] Thus, if resending is repeated even when a condition with an inferior circuit continues for a long time by transmitting on a hierarchy who does rotation of the hierarchy at the time of resending, and is different from last time, a cel can be transmitted on a hierarchy with the automatic highest quality, the probability of re-resending is reduced, and a cel waste ratio can be reduced.
[0090] In addition, in the gestalt 2 of operation, there is no limit in the number of hierarchies, or a control algorithm. Moreover, although every one hierarchy who writes a cel at every resending is raised with the gestalt 2 of operation, other control, such as raising the hierarchy who writes in the cel to resend to a hierarchy 1 unconditionally, can also be performed.
[0091] (Gestalt 3 of operation) Drawing 6 is the block diagram showing the partial configuration of the radio communication equipment in the gestalt 3 of operation of this invention. Drawing 6

(a) shows the configuration of the hierarchy modulator of a radio communication equipment, and drawing 6 (b) shows the configuration of the hierarchy demodulator of a radio communication equipment.

[0092] The hierarchy modulator 103 shown in drawing 6 (a) possesses two or more diffusers 601, 602, and 603 which perform diffusion process, the adder 604 adding the diffusion signal outputted from each diffuser, and the modulator 605 which modulates the added diffusion signal.

[0093] Moreover, the hierarchy demodulator 123 shown in drawing 6 (b) possesses the RAKE receivers 654, 655, and 656 which carry out RAKE composition of the output of two or more back-diffusion-of-electrons machines 651, 652, and 653 which perform back-diffusion-of-electrons processing, and each back-diffusion-of-electrons machine.

[0094] A diffuser 601 performs diffusion process using the diffusion sign A to the cel which was able to be distributed to the hierarchy 1, and amplifies a diffusion signal based on the level-setting signal A. Similarly, a diffuser 602 performs diffusion process using the diffusion sign B to the cel which was able to be distributed to the hierarchy 2, and amplifies a diffusion signal based on the level-setting signal B. Moreover, a diffuser 603 performs diffusion process using the diffusion sign C to the cel which was able to be distributed to the hierarchy 3, and amplifies a diffusion signal based on the level-setting signal C.

[0095] Here, since a quality difference is given to each hierarchy, the level-setting signal A, the level-setting signal B, and the level-setting signal C specify level different, respectively. In addition, the diffusion sign A, the diffusion sign B, and the diffusion sign C have an orthogonality mutually.

[0096] After the diffusion signal outputted from each diffuser is added with an adder 604, it becomes irregular with a modulator 605 and it is outputted from the hierarchy modulator 103 as a hierarchy modulation output.

[0097] The back-diffusion-of-electrons machine 651 performs the back diffusion of electrons with the same diffusion sign A with having used for the diffusion process of a diffuser 601 to the inputted signal, and takes out the cel which was able to be distributed to the hierarchy 1. The RAKE composition machine 654 carries out RAKE composition of the cel outputted from the back-diffusion-of-electrons machine 651.

[0098] Similarly, the back-diffusion-of-electrons machine 652 performs the back diffusion of electrons with the same diffusion sign B with having used for the diffusion process of a diffuser 602 to the inputted signal, and takes out the cel which was able to be distributed to the hierarchy 2. The RAKE composition machine 655 carries out RAKE composition of the cel outputted from the back-diffusion-of-electrons machine 652.

[0099] Moreover, the back-diffusion-of-electrons machine 653 performs the back diffusion of electrons with the same diffusion sign C with having used for the diffusion process of a diffuser 603 to the inputted signal, and takes out the cel which was able to be distributed to the hierarchy 3. The RAKE composition machine 656 carries out RAKE composition of the cel outputted from the back-diffusion-of-electrons machine 653.

[0100] Thereby, in the radio communications system of a CDMA method, a data transmission rate can be automatically changed in accordance with a circuit situation, without delivering rate selection information between a transmitting side and a receiving side.

[0101] (Gestalt 4 of operation) Drawing 7 is the block diagram showing the partial configuration of the radio communication equipment in the gestalt 4 of operation of this invention. Drawing 7 (a) shows the configuration of the hierarchy modulator of a radio communication equipment, and drawing 7 (b) shows the configuration of the hierarchy demodulator of a radio communication equipment.

[0102] The hierarchy modulator 103 shown in drawing 7 (a) possesses two or more modulators 701, 702, and 703 modulated using a respectively different subcarrier, and the adder 704 adding the modulating signal outputted from each modulator.

[0103] Moreover, the hierarchy demodulator 123 shown in drawing 7 (b) possesses two or more demodulators 751, 752, and 753 which perform recovery processing.

[0104] A modulator 701 performs modulation processing using Subcarrier A to the cel which was able to be distributed to the hierarchy 1, and amplifies the modulated signal based on the level-

setting signal A. Similarly, a modulator 702 performs modulation processing using Subcarrier B to the cel which was able to be distributed to the hierarchy 2, and amplifies the modulated signal based on the level-setting signal B. Moreover, a modulator 703 performs modulation processing using Subcarrier C to the cel which was able to be distributed to the hierarchy 3, and amplifies the modulated signal based on the level-setting signal C.
[0105] Here, since a quality difference is given to each hierarchy, the level-setting signal A, the level-setting signal B, and the level-setting signal C specify level different, respectively. In addition, in order to perform multi-carrier transmission, Subcarrier A, Subcarrier B, and Subcarrier C specify a different subcarrier so that an orthogonality may be kept mutual.
[0106] The signal outputted from each modulator is added with an adder 704, and is outputted from the hierarchy modulator 103 as a hierarchy modulation output.
[0107] To the inputted signal, a demodulator 751 performs recovery processing by the same subcarrier A as modulation processing of a modulator 701, and takes out the cel which was able to be distributed to the hierarchy 1. Similarly, to the inputted signal, a demodulator 752 performs recovery processing by the same subcarrier B as modulation processing of a modulator 702, and takes out the cel which was able to be distributed to the hierarchy 2. Moreover, to the inputted signal, a demodulator 753 performs recovery processing by the same subcarrier C as modulation processing of a modulator 703, and takes out the cel which was able to be distributed to the hierarchy 3.
[0108] Thereby, in the radio communications system of a multi-carrier method, a data transmission rate can be automatically changed in accordance with a circuit situation, without delivering rate selection information between a transmitting side and a receiving side. Moreover, radio can be performed by giving orthogonality relation to each frequency in OFDM which is a kind of a multi-carrier method.
[0109] (Gestalt 5 of operation) Drawing 8 is the block diagram showing the partial configuration of the radio communication equipment in the gestalt 5 of operation of this invention. Drawing 8 (a) shows the configuration of the hierarchy modulator of a radio communication equipment, and drawing 8 (b) shows the configuration of the hierarchy demodulator of a radio communication equipment.
[0110] The hierarchy modulator 103 shown in drawing 8 (a) possesses two or more mapping machines 801, 802, and 803 which perform respectively different mapping processing, the connection switches 804, 805, and 806 which adjust the output timing of each mapping machine, the adder 807 adding the mapped signal, and the modulator 808 which modulates the added signal.
[0111] Moreover, the hierarchy demodulator 123 shown in drawing 8 (b) possesses two or more demodulators 851, 852, and 853 which perform recovery processing.
[0112] The mapping machine 801 performs mapping by the BPSK modulation to the cel which was able to be distributed to the hierarchy 1. Similarly, the mapping machine 802 performs mapping by the QPSK modulation to the cel which was able to be distributed to the hierarchy 2. Moreover, the mapping machine 803 maps using Subcarrier C to the cel which was able to be distributed to the hierarchy 3.
[0113] After the output of each mapping machine is outputted to an adder 807 by the control to the connection switches 804, 805, and 806 of timing signal A, timing signal B, and timing signal C and is added to different time amount with an adder 807, it becomes irregular with a modulator 808 and it is outputted from the hierarchy modulator 103 as a hierarchy modulation output.
[0114] Thus, the signal from which quality differs by time amount can be transmitted by outputting the signal with which mapping differs to different time amount.
[0115] To the inputted signal, a demodulator 851 performs recovery processing using timing signal A, and takes out the cel which was able to be distributed to the hierarchy 1. Similarly, to the inputted signal, a demodulator 852 performs recovery processing using timing signal B, and takes out the cel which was able to be distributed to the hierarchy 2. Moreover, to the inputted signal, a demodulator 853 performs recovery processing using timing signal C, and takes out the cel which was able to be distributed to the hierarchy 3.
[0116] Thereby, in the radio communication equipment of a TDMA method, a data transmission

rate can be automatically changed in accordance with a circuit situation, without delivering rate selection information between a transmitting side and a receiving side.

[0117] (Gestalt 6 of operation) Drawing 9 is the block diagram showing the partial configuration of the radio communication equipment in the gestalt 6 of operation of this invention. Drawing 9 (a) shows the configuration of the hierarchy modulator of a radio communication equipment, and drawing 9 (b) shows the configuration of the hierarchy demodulator of a radio communication equipment.

[0118] The hierarchy modulator 103 shown in drawing 9 (a) possesses two or more diffusers 901, 902, and 903 which perform diffusion process, the connection switches 904, 905, and 906 which adjust the output timing of each diffuser, the adder 907 adding each diffusion signal, and the modulator 908 which modulates the added diffusion signal.

[0119] Moreover, the hierarchy demodulator 123 shown in drawing 9 (b) possesses the RAKE receivers 954, 955, and 956 which carry out RAKE composition of the output of two or more back-diffusion-of-electrons machines 951, 952, and 953 which perform back-diffusion-of-electrons processing, and each back-diffusion-of-electrons machine.

[0120] A diffuser 901 performs diffusion process using the diffusion sign A to the cel which was able to be distributed to the hierarchy 1, and amplifies a diffusion signal based on the level-setting signal A. Similarly, a diffuser 902 performs diffusion process using the diffusion sign B to the cel which was able to be distributed to the hierarchy 2, and amplifies a diffusion signal based on the level-setting signal B. Moreover, a diffuser 903 performs diffusion process using the diffusion sign C to the cel which was able to be distributed to the hierarchy 3, and amplifies a diffusion signal based on the level-setting signal C.

[0121] Here, since a quality difference is given to each hierarchy, the diffusion sign A, the diffusion sign B, and the diffusion sign C have a diffusion coefficient different, respectively. Moreover, since a quality difference is given to each hierarchy, the level-setting signal A, the level-setting signal B, and the level-setting signal C may use specifying level different, respectively together. A fixed then signal with a larger diffusion coefficient is more nearly quality in all transmission levels.

[0122] After the diffusion signal outputted from each diffuser is outputted to an adder by the control to the connection switches 904, 905, and 906 of timing signal A, timing signal B, and timing signal C and is added to different time amount with an adder 907, it becomes irregular with a modulator 908 and it is outputted from the hierarchy modulator 103 as a hierarchy modulation output.

[0123] Thus, the signal from which quality differs by time amount can be transmitted by outputting the signal with which diffusion coefficients differ to different time amount.

[0124] The back-diffusion-of-electrons machine 951 performs the back diffusion of electrons with the same diffusion sign A with having used for the diffusion process of a diffuser 901 to the inputted signal, and takes out the cel which was able to be distributed to the hierarchy 1. The RAKE composition machine 954 carries out RAKE composition of the cel outputted from the back-diffusion-of-electrons machine 951. Similarly, the back-diffusion-of-electrons machine 952 performs the back diffusion of electrons with the same diffusion sign B with having used for the diffusion process of a diffuser 902 to the inputted signal, and takes out the cel which was able to be distributed to the hierarchy 2. The RAKE composition machine 955 carries out RAKE composition of the cel outputted from the back-diffusion-of-electrons machine 952. Moreover, the back-diffusion-of-electrons machine 953 performs the back diffusion of electrons with the same diffusion sign C with having used for the diffusion process of a diffuser 903 to the inputted signal, and takes out the cel which was able to be distributed to the hierarchy 3. The RAKE composition machine 956 carries out RAKE composition of the cel outputted from the back-diffusion-of-electrons machine 953.

[0125] Thereby, in the radio communications system of a CDMA method, a data transmission rate can be automatically changed and introduced in accordance with a circuit situation, without delivering rate selection information between a transmitting side and a receiving side.

[0126]

[Effect of the Invention] As explained above, according to a receiving set and the data

transmission approach, in the sending set list of this invention By distributing a sending signal to two or more hierarchies in a cel unit, performing coding which can carry out error detection for every hierarchy, carrying out a hierarchy modulation, transmitting, getting over for every hierarchy, performing error detection, and performing a resending demand for every hierarchy by the receiving side, in a transmitting side According to the situation of a circuit, a data transmission rate can be changed automatically, without delivering rate selection information between equipment. It is not necessary to avoid malfunction by the error of a control signal, to respond also in the time of high-speed phasing by this, and to take the presumed precision of receiving quality into consideration.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention is carried in a radio communication equipment, and relates to a receiving set and the data transmission approach at the sending set list to which a data transmission rate is changed according to a circuit situation.

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PRIOR ART

[Description of the Prior Art] In a radio communications system, according to a circuit situation, a data transmission rate may be controlled accommodative, and the data transmission approach which raises the average transmission efficiency of data may be adopted.
[0003] Hereafter, the radio communication equipment which carries out adaptive control of the conventional data transmission rate is explained using a drawing.
[0004] Drawing 10 is the block diagram showing the configuration of the radio communication equipment in the conventional TDD transmission system. Drawing 10 (a) is the block diagram showing the configuration of the side (henceforth a "transmitting side") which carries out adaptive control of the data transmission rate, and transmits data, and drawing 10 (b) is the block diagram showing the configuration of the side (henceforth a "receiving side") which receives the data by which adaptive control was carried out in the data transmission rate.
[0005] The transmitting side of the radio communication equipment shown in drawing 10 (a) The data buffer 1 which stores a sending signal temporarily, and the modulator 2 which performs a BPSK modulation to a sending signal, The modulator 3 which performs a QPSK modulation to a sending signal, and the modulator 4 which performs 16 AM to a sending signal, The amplifier 5 which amplifies the modulated signal, and the antenna 6 which carries out the wireless transmission and reception of the signal, The level measuring instrument 7 which measures the level of the signal received from the antenna 6, A data transmission rate is chosen from a received signal level, and it mainly consists of a rate selector 8 which generates the rate selection information which shows a data transmission rate, and switches 9 and 10 which change by the rate selector 8 and are controlled.
[0006] Moreover, the receiving side of the radio communication equipment shown in drawing 10 (b) The antenna 21 which carries out the wireless transmission and reception of the signal, and the amplifier 22 which amplifies an input signal, The demodulator 23 which performs a BPSK recovery to an input signal, and the demodulator 24 which performs a QPSK recovery to an input signal, The demodulator 25 which performs a 16QAM recovery to an input signal, and the data buffer 26 which stores the signal to which it restored, It mainly consists of switches 29 and 30 which change with the BPSK demodulator 27 which carries out the BPSK recovery of the input signal, and extracts rate selection information, the rate detector 28 which detects a data transmission rate from the output of the BPSK demodulator 27, and the rate detector 28, and are controlled.
[0007] By getting down with an uphill circuit in the case of a TDD transmission system, since the propagation path of a circuit is the same, the level of an input signal can be measured in a transmitting side, and the modulation technique of a sending signal can be chosen based on the level of the input signal.
[0008] The rate selector 8 of a transmitting side chooses modulation techniques, such as 16QAM with a high data transmission rate, and controls switches 9 and 10, when the level of an input signal is large, it judges that a circuit situation is good, an error and a cone judge it that a circuit situation is bad, when level is low, and although a data transmission rate is low, it chooses modulation techniques, such as a pile BPSK, as an error, and controls switches 9 and 10. Furthermore, the rate selector 8 stores rate selection information in a data buffer 1.

[0009] The sending signal stored in the data buffer 1 is modulated by the modulation technique chosen by the rate selector 8. However, rate selection information is always modulated by the BPSK method, in order to make an error hard to produce. After the modulated signal is amplified with amplifier 5, wireless transmission of it is carried out from an antenna 6.
[0010] After the signal received by the antenna 21 of a receiving side is amplified with amplifier 22, rate selection information is extracted by the BPSK demodulator 27, and a data transmission rate is detected by the rate detector 28. And based on the detected data transmission rate, change control is carried out and switches 29 and 30 restore to an input signal by the recovery method of the same data transmission rate as a modulation technique. A recovery result is taken out as an input signal, after being stored in a data buffer 26.
[0011] Drawing 11 is the block diagram showing the configuration of the radio communication equipment in the conventional FDD transmission system. Drawing 11 (a) shows the configuration of a transmitting side, and drawing 11 (b) shows the configuration of a receiving side. In addition, in drawing 11 , about the same component as drawing 10 , the same sign as drawing 10 is attached and explanation is omitted.
[0012] Since in the case of a FDD transmission system it gets down with an uphill circuit and the propagation paths of a circuit differ, in a receiving side, the level of an input signal is measured and the modulation technique of a sending signal is chosen based on the level of an input signal.
[0013] The transmitting side of the radio communication equipment shown in drawing 11 as compared with drawing 10 possesses the amplifier 11 which amplifies an input signal, the demodulator 12 which extracts rate selection information from an input signal, and the rate detector 13 which detects a data transmission rate from rate selection information instead of the level measuring instrument 7 and the rate selector 8.
[0014] Moreover, a receiving side possesses the level measuring instrument 31 which measures a received signal level, the rate selector 32 which generates the rate selection information which chooses a data transmission rate from receiving level, and shows a data transmission rate, the modulator 33 which modulates rate selection information, and the amplifier 34 which amplifies the modulated rate selection information instead of the BPSK demodulator 27 and the rate selector 28.
[0015] The rate selector 32 of a receiving side judges that a circuit situation is good, when the level of an input signal is large, and an error and a cone choose modulation techniques, such as 16QAM with a high data transmission rate, and it outputs rate selection information to a modulator 33. Moreover, the rate selector 32 judges that a circuit situation is inferior, when the level of an input signal is small, although a data transmission rate is low, it chooses modulation techniques, such as a pile BPSK, as an error, and it outputs rate selection information to a modulator 33. After becoming irregular by the BPSK method which is a modulation technique which an error cannot produce easily and amplifying rate selection information with amplifier 34 with a modulator 33, it is transmitted to a transmitting side from an antenna 21.
[0016] Moreover, the rate selector 32 makes the preparations which control switches 29 and 30 and perform the recovery corresponding to the specified data transmission rate at the same time it outputs rate selection information. A recovery result is taken out as an input signal, after being stored in a data buffer 26.
[0017] After the signal received by the antenna 6 of a transmitting side is amplified with amplifier 11, it gets over with a demodulator 12 and rate selection information is extracted. And a data transmission rate is detected from rate selection information, switches 9 and 10 are controlled by the rate detector 13, and the data transmission rate of a sending signal is determined with it.
[0018] It is once stored in a data buffer 1, and becomes irregular according to control of the rate detector 13 with the BPSK modulator 2, the QPSK modulator 3, or the 16QAM modulator 4, and after a sending signal is amplified with amplifier 5, it is transmitted to a receiving side from an antenna 6.
[0019] Thus, the average transmission efficiency of data is raised by the radio communication equipment which carries out adaptive control of the conventional data transmission rate raising transmission efficiency using a modulation technique with a high data transmission rate, when a

circuit situation is good, and making data transmit to an error certainly using a pile modulation technique, when a circuit situation is inferior, although a data transmission rate is low.

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to a receiving set and the data transmission approach, in the sending set list of this invention By distributing a sending signal to two or more hierarchies in a cel unit, performing coding which can carry out error detection for every hierarchy, carrying out a hierarchy modulation, transmitting, getting over for every hierarchy, performing error detection, and performing a resending demand for every hierarchy by the receiving side, in a transmitting side According to the situation of a circuit, a data transmission rate can be changed automatically, without delivering rate selection information between equipment. It is not necessary to avoid malfunction by the error of a control signal, to respond also in the time of high-speed phasing by this, and to take the presumed precision of receiving quality into consideration.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, the above-mentioned conventional radio communication equipment has the technical problem that transmission efficiency will fall on the contrary, when rate selection information must be delivered by the transmitting side and the receiving side and rate selection information is mistaken. Moreover, when multi-pass phasing happens, it has the technical problem that just receiving level is inadequate and the presumed precision of receiving quality worsens as a decision ingredient of a circuit situation. Furthermore, since the circuit situation at the rate selection and signal transmitting time changes when a phasing rate is quick, it has the technical problem that transmission efficiency cannot fully be improved.
[0021] This invention aims at providing with a receiving set and the data transmission approach the sending set list which changes a data transmission rate automatically in accordance with a circuit situation, without being made in view of this point and delivering rate selection information.

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MEANS

[Means for Solving the Problem] A means to restore to an input signal in a receiving side by this invention's performing coding processing which distributes a sending signal to two or more hierarchies in a cel unit in a transmitting side, and can carry out error detection for every hierarchy, carrying out a hierarchy modulation, and transmitting in order to solve the above-mentioned technical problem, to have performed error detection for every hierarchy, and to perform a resending demand for every hierarchy was provided.
[0023]
[Embodiment of the Invention] Invention of the sending set in the 1st mode of this invention A coding means to distribute a sending signal to two or more hierarchies in a cel unit, and to perform coding for error detection for every hierarchy, The configuration possessing a transmission-control means to accumulate the encoded cel, to output a new cel when there is no resending demand, and to re-output the cel concerned when there is a resending demand, and a hierarchy modulation means to perform a hierarchy modulation to the cel outputted from this transmission-control means is taken.
[0024] moreover, the 9th voice of this invention -- invention of the receiving set which can be set like restores to the signal by which the hierarchy modulation was carried out in a transmitting side, and takes the configuration possessing the hierarchy recovery means which takes out each hierarchy's cel, an error detection means perform error detection of a cel for every hierarchy, and a resending demand transmitting means transmit the resending demand signal about the cel which detected the error.
[0025] moreover, the 19th voice of this invention -- invention of the data-transmission approach which can be set like distributes a sending signal to two or more hierarchies in a cel unit in a transmitting side, performs coding for error detection for every hierarchy, it performs a hierarchy modulation to the encoded cel, restores to the signal by which the hierarchy modulation was carried out in a receiving side, takes out each hierarchy's cel, and takes the approach of performing error detection of a cel for every hierarchy.
[0026] Moreover, in the data transmission approach in the 19th mode, invention in the 20th mode of this invention transmits the resending demand signal about the cel which detected the error in the receiving side, when there is no resending demand at a transmitting side, it outputs a new cel, and when there is a resending demand, it takes the approach of re-outputting the cel concerned.
[0027] Here, a hierarchy modulation is a method which distinguishes between the quality of two or more signals transmitted by the same circuit, and is modulated by the device of signal point arrangement etc.
[0028] By these configurations, in a transmitting side, a sending signal is distributed to two or more hierarchies in a cel unit, coding processing whose error detection is possible for every hierarchy is performed, a hierarchy modulation is performed, and according to a circuit situation, the adaptive control of the data transmission rate can be carried out automatically at a receiving side, without being able to perform error detection for every hierarchy and delivering rate selection information.
[0029] moreover, the 2nd voice of this invention -- invention which can be set like -- the 1st

voice -- in the sending set which can be set like, a transmission-control means takes the configuration possessing the 1st buffer which accumulates the encoded cel, the hierarchy control means which controls the hierarchy of the cel written in the 1st buffer, and the 2nd buffer which accumulates the cel controlled by this hierarchy control means for every hierarchy.
[0030] Moreover, invention in the 3rd mode of this invention takes the configuration which re-outputs the cel in which the hierarchy control means had a resending demand on a different hierarchy from last time in the sending set in the 2nd mode.
[0031] Moreover, invention in the 21st mode of this invention takes the approach of re-outputting a cel with a resending demand on a different hierarchy from last time in the data transmission approach of the 19th mode or the 20th mode.
[0032] By these configurations, if resending is repeated even when a condition with an inferior circuit continues for a long time in order to transmit on the last hierarchy and a different hierarchy at the time of resending, a cel can be transmitted on a hierarchy with the automatic highest quality, the probability of re-resending is reduced, and a cel waste ratio can be reduced.
[0033] moreover, the 4th voice of this invention -- invention which can set like -- the 1st mode thru/or the 3rd voice -- in one of sending sets [like], a hierarchy modulation means takes the configuration possessing a diffusion means diffuses with a different sign for every hierarchy, and output with a different transmission level, an addition means add the output of this diffusion means, and a modulation means modulate the output of this addition means.
[0034] Moreover, invention in the 5th mode of this invention takes the configuration which diffuses a diffusion means with the sign of a different diffusion coefficient for every hierarchy, and is outputted to different timing in the sending set of the 4th mode.
[0035] moreover, the 10th voice of this invention -- invention which can be set like -- the 9th voice -- in a receiving sending set [like], the back diffusion of electrons of the hierarchy recovery means is carried out with the same sign as the diffusion process of a transmitting side, and it takes the configuration possessing the back-diffusion-of-electrons means which takes out each hierarchy's cel, and the RAKE composition means which carries out RAKE composition of each hierarchy's cel.
[0036] By these configurations, a data transmission rate can be automatically changed in accordance with a circuit situation in the radio communications system of a CDMA method, without delivering rate selection information between a transmitting side and a receiving side.
[0037] moreover, the 6th voice of this invention -- invention which can be set like -- the 1st mode thru/or the 3rd voice -- in one of sending sets [like], a hierarchy modulation means takes the configuration possessing a carrier modulation means to modulate on a different frequency for every hierarchy, and to output with a different transmission level, and an addition means to add the output of this carrier modulation means.
[0038] moreover, the 11th voice of this invention -- invention which can be set like -- the 9th voice -- in a receiving sending set [like], it gets over on the same frequency as modulation processing of a transmitting side, and a hierarchy recovery means takes the configuration possessing the recovery means which takes out each hierarchy's cel.
[0039] By these configurations, a data transmission rate can be automatically changed in accordance with a circuit situation in the radio communications system of a multi-carrier method, without delivering rate selection information between a transmitting side and a receiving side.
[0040] Moreover, the configuration in which, as for invention in the 7th mode of this invention, each frequency modulates a carrier modulation means in the sending set of the 6th mode so that it may have orthogonality relation is taken.
[0041] By this configuration, a data transmission rate can be automatically changed in accordance with a circuit situation in the radio communications system using OFDM which is a kind of a multi-carrier method, without delivering rate selection information between a transmitting side and a receiving side.
[0042] moreover, the 8th voice of this invention -- invention which can set like -- the 1st mode thru/or the 3rd voice -- in one of sending sets [like], a hierarchy modulation means takes the configuration possessing a mapping means performs different mapping processing for every

hierarchy, and output it to different timing, an addition means add the output of this mapping means, and a modulation means modulate the output of this addition means.
[0043] moreover, the 12th voice of this invention -- invention which can be set like -- the 9th voice -- in a receiving sending set [like], it gets over to the same timing as mapping processing of a transmitting side, and a hierarchy recovery means takes the configuration possessing the recovery means which takes out each hierarchy's cel.
[0044] By these configurations, a data transmission rate can be automatically changed in accordance with a circuit situation in the radio communication equipment of a TDMA method, without delivering rate selection information between a transmitting side and a receiving side.
[0045] Moreover, invention of the communication terminal in the 13th mode of this invention takes the configuration which carries a sending set according to claim 1 to 8, and performs radio. In addition, the mobile station equipment in migration communication system is included in a communication terminal.
[0046] Moreover, invention of the base station equipment in the 14th mode of this invention carries a receiving set according to claim 9 to 12, and takes the configuration which performs the communication terminal and radio of claim written 13 publication.
[0047] Moreover, invention of the base station equipment in the 15th mode of this invention takes the configuration which carries a sending set according to claim 1 to 8, and performs radio.

[0048] Moreover, invention of the communication terminal in the 16th mode of this invention carries a receiving set according to claim 9 to 12, and takes the configuration which performs base station equipment according to claim 15 and radio.
[0049] Moreover, invention of the radio communications system in the 17th mode of this invention takes the configuration which performs radio with a communication terminal according to claim 13 and base station equipment according to claim 14.
[0050] Moreover, invention of the radio communications system in the 18th mode of this invention takes the configuration which performs radio with a communication terminal according to claim 16 and base station equipment according to claim 15.
[0051] Hereafter, the gestalt of operation of this invention is explained to a detail with reference to an accompanying drawing.
(Gestalt 1 of operation) Drawing 1 is the block diagram showing the configuration of the radio communication equipment in the gestalt 1 of operation of this invention. The side (henceforth a "transmitting side") which drawing 1 (a) carries out the hierarchy modulation of the data, and transmits is shown, and drawing 1 (b) shows the side (henceforth a "receiving side") which receives the data by which the hierarchy modulation was carried out.
[0052] The encoder 101 with which the transmitting side of the radio communication equipment shown in drawing 1 (a) performs coding for error detection to a sending signal, The data buffer 102 which stores the encoded sending signal temporarily, It mainly consists of the hierarchy modulator 103 which performs a hierarchy modulation to the encoded signal, the amplifier 104 which amplifies the signal by which the hierarchy modulation was carried out, an antenna 105 which transmit and receive a signal, amplifier 106 which amplifies the resending demand signal from a receiving side, and a demodulator 107 which restores to a resending demand signal.
[0053] The receiving side shown in drawing 1 (b) mainly consists of the antenna 151 which transmits and receives a signal, the amplifier 152 which amplifies an input signal, the hierarchy demodulator 153 which performs a hierarchy recovery to the amplified input signal, the error-detection machines 154 and 155 which detect the error of an input signal, a data buffer 157 which stores an input signal temporarily, a modulator 158 which modulates a resending demand signal, and amplifier 159 which amplifies a resending demand signal.
[0054] The encoder 101 of a transmitting side distributes a sending signal to two or more hierarchies in a cel unit, it encodes so that error detection may be possible for every hierarchy, and it is stored in a data buffer 102. A hierarchy modulation is carried out with the hierarchy modulator 103, and the cel which was able to be distributed to each hierarchy is amplified with amplifier 104, and is transmitted from an antenna 105.
[0055] Hereafter, a hierarchy modulation is explained using drawing showing signal point

arrangement of the QPSK modulation shown in drawing 2 . Drawing 2 (a) shows signal point arrangement of the usual QPSK modulation, and since the distance 201 between the signal points of I component and the distance 202 between the signal points of Q component are equal, it is the same as that of the quality of Q component. [of the quality of I component] Drawing 2 (b) shows signal point arrangement of the QPSK modulation which performed hierarchy modulation processing, and since the distance 251 between signal points of I component is longer than the distance 252 between signal points of Q component, its quality of I component is better than the quality of Q component. Moreover, although the quality of Q component is bad to drawing 2 (a), the quality of drawing 2 (b) of I component is good.

[0056] The signal received with the antenna 151 is amplified with amplifier 152, a hierarchy recovery is carried out with the hierarchy demodulator 153, and each hierarchy's cel is taken out. Error detection processing of the cel by which the hierarchy modulation was carried out is carried out for every hierarchy with the error detection vessels 154 and 155, and the resending demand signal about the cel in which the error was detected is outputted. It becomes irregular with a modulator 158, and a resending demand signal is amplified with amplifier 159, and is transmitted from an antenna 151.

[0057] Via an antenna 105 and an amplifier 106, the resending demand signal transmitted from the receiving side is detected by the demodulator 107, and is outputted to a data buffer 102. And the cel with a resending demand is automatically read from a data buffer 102 again, and is resent.

[0058] For example, if it considers as I component which shows the hierarchy 1 in drawing 1 to drawing 2 (b) and is Q component which shows the hierarchy 2 in drawing 1 to drawing 2 (b), even when a circuit condition is inferior, since the hierarchy 1 with high quality can succeed in data transmission, he can secure the transmission efficiency of the BPSK average which is the data transmission rate of 1 bit per one symbol. In addition, resending is repeated until the cel transmitted by the hierarchy 2 succeeds in data transmission. However, the cel concerned is discarded when a retry count exceeds buffer size.

[0059] On the other hand, since the hierarchy 2 with low quality can also succeed in data transmission in addition to a hierarchy 1 when a circuit situation is good, the transmission efficiency of the QPSK average which is the data transmission rate of 2 bits per one symbol can be acquired.

[0060] Thus, according to a circuit situation, the adaptive control of the data transmission rate can be automatically carried out in a transmitting side, without delivering rate selection information by distributing a sending signal to two or more hierarchies in a cel unit, performing coding processing whose error detection is possible for every hierarchy, performing a hierarchy modulation, and performing error detection for every hierarchy by the receiving side.

[0061] In addition, although the gestalt 1 of operation explains the case where the number of hierarchies is two, a limit does not have this invention in a hierarchy's phase, and it may use how many steps of hierarchies for it.

[0062] (Gestalt 2 of operation) Drawing 3 is the block diagram showing the configuration of the radio communication equipment in the gestalt 2 of operation. Drawing 3 (a) shows a transmitting side and drawing 3 (b) shows a receiving side. In addition, in drawing 3 , about the same component as drawing 1 , the same sign as drawing 1 is attached and explanation is omitted.

[0063] As compared with drawing 1 , the transmission-control machine 301 which controls the hierarchy of a sending signal, and the TMP buffers 302, 303, and 304 which store a cel temporarily are added to the transmitting side of the radio communication equipment shown in drawing 3 . Moreover, although the case where the number of hierarchies is 2 is shown and drawing 3 shows the case where the number of hierarchies is 3 at drawing 1 , for explanation, there is no fundamental configuration difference by this.

[0064] The transmission-control machine 301 controls the hierarchy of each cel stored in the data buffer 102, and stores him in the TMP buffers 302, 303, and 304. Moreover, elimination processing of the cel written in a data buffer 102 and the TMP buffers 302, 303, and 304 is performed. Moreover, when a resending demand signal is inputted from a demodulator 107, it controls to transmit the cel to resend on a different hierarchy from last time by writing an

applicable cel in a different TMP buffer from last time.
[0065] Next, the control action of the transmission-control machine 301 is explained using the mimetic diagram shown in the flow Fig. and drawing 5 which are shown in drawing 4 . In addition, I in drawing 4 shows the number of hierarchies. Moreover, quality is a good hierarchy, so that i is small, a hierarchy 1 is the quality and Hierarchy I considers as what has the worst quality.
[0066] First, the cel written in all the TMP buffers 302, 303, and 304 at the time of transmitting initiation is eliminated (ST401). Next, the transmitting cel inputted from the data buffer 102 is written in the vacant TMP buffers 302, 303, and 304 (ST402). In addition, a hierarchy modulation is carried out with the hierarchy modulator 103, the cel written in each TMP buffer has the amplitude amplified with amplifier 104, and wireless transmission is carried out from an antenna 105.
[0067] Completion of transmission of a transmitting cel eliminates the cel written in all the TMP buffers 302, 303, and 304 (ST404). (ST403)
[0068] Next, it judges whether there was any resending demand from a receiving side to the cel transmitted on the hierarchy 2 (ST405, ST406). And when there is a resending demand to an applicable cel by ST406, it judges whether the retry count of the cel concerned is over buffer size (ST407).
[0069] And when the retry count of an applicable cel is not over buffer size by ST407, from the hierarchy who transmitted last time, one rank is raised and it writes in a TMP buffer (ST408, ST409). Since it can transmit to an error on a pile hierarchy most automatically while repeating a resending demand by raising one rank of hierarchies of the cel to resend, and transmitting, the probability of re-resending can be reduced, a cel waste ratio can be reduced, and certainty of transmission can be made high.
[0070] Moreover, when there is no resending demand to an applicable cel at ST406, or when it is over buffer size by ST407, an applicable cel is deleted from a data buffer 102 (ST410).
[0071] And actuation of ST406 to ST410 is repeated to the cel transmitted on a hierarchy 3 to the hierarchy I (ST411, ST412, ST413).
[0072] Next, it judges whether there was any resending demand from a receiving side to the cel transmitted on the hierarchy 1 (ST414, ST406). And when there is a resending demand by ST406, it judges whether the retry count of the cel concerned is over buffer size (ST407).
[0073] And when the retry count of an applicable cel is not over buffer size by ST407, it judges whether the cel is already written in a hierarchy's 1 TMP buffer (ST408, ST415).
[0074] By ST415, when the cel is already written in a hierarchy's 1 TMP buffer, the cel concerned is written in Hierarchy's I TMP buffer (ST416).
[0075] Moreover, by ST415, when a hierarchy's 1 TMP buffer is vacant, the cel concerned is written in a hierarchy's 1 TMP buffer (ST417).
[0076] Moreover, when there is no resending demand at ST406, or when it is over buffer size by ST407, an applicable cel is deleted from a data buffer 102 (ST410).
[0077] And it judges whether the cel which is not transmitted to a data buffer 102 remains, and when the cel which be still transmitted and which is not remains, actuation of ST402 to ST417 is repeated. Moreover, data transmission is ended when transmission of all cels is completed (ST418).
[0078] Drawing 5 is a mimetic diagram showing the cel written in the TMP buffer of each hierarchy of the radio communication equipment in the gestalt 2 of operation.
[0079] First, in F501, a cel P2 is written in a cel P1 and a hierarchy 2, and a cel P3 is written in a hierarchy 1 at a hierarchy 3.
[0080] Supposing an error arises only to a hierarchy 3 in a receiving side as a result of the transmission in F501, a resending demand of a hierarchy 3 will be given to a transmitting side. In F502, a cel P3 is written in a hierarchy 2 according to a resending demand. Moreover, a new cel P4 and a new cel P5 are written in vacant hierarchy 1 and hierarchy 3.
[0081] Supposing all cels mistake by the receiving side and it is received that there is nothing as a result of the transmission in F502, a resending demand will not be given to a transmitting side. Therefore, in F503, the new cel P6, a cel P7, and a cel P8 are written in all hierarchies.
[0082] Supposing an error arises to both a hierarchy 2 and the hierarchy 3 in a receiving side as

a result of the transmission in F503, a resending demand of a hierarchy 2 and a hierarchy 3 will be given to a transmitting side. In F504, according to a resending demand, a cel P7 is written in a hierarchy 1, and a cel P8 is written in a hierarchy. Moreover, a cel P9 is written in the vacant hierarchy 3.

[0083] Here, an error does not arise to a hierarchy 3 but an error may arise to the more nearly quality hierarchy 2 than a hierarchy 3. Supposing an error arises only to a hierarchy 2 in a receiving side as a result of the transmission in F504, a resending demand of a hierarchy 2 will be given to a transmitting side. In F505, a cel P8 is written in a hierarchy 1 according to a resending demand. Moreover, a new cel P10 and a new cel P11 are written in vacant hierarchy 2 and hierarchy 3.

[0084] Supposing an error arises to all the hierarchies 2 in a receiving side as a result of the transmission in F505, a resending demand of all hierarchies will be given to a transmitting side. In F506, according to a resending demand, a cel P10 is written in a hierarchy 1, a cel P11 is written in a hierarchy 2, and a cel 8 is written in a hierarchy 3.

[0085] Supposing an error arises only to a hierarchy 3 in a receiving side as a result of the transmission in F506, a resending demand of a hierarchy 3 will be given to a transmitting side. In F507, a cel P8 is written in a hierarchy 2 according to a resending demand. Moreover, a new cel P12 and a new cel P13 are written in vacant hierarchy 1 and hierarchy 3.

[0086] Supposing an error arises to a hierarchy 2 and a hierarchy 3 in a receiving side as a result of the transmission in F507, a resending demand of a hierarchy 2 and a hierarchy 3 will be given to a transmitting side. Here, since a cel P8 serves as delay exceeding buffer size, it is discarded. Therefore, in F508, a cel P13 is written in a hierarchy 2 according to a resending demand. Moreover, a new cel P14 and a new cel P15 are written in vacant hierarchy 1 and hierarchy 3.

[0087] Supposing an error arises only to a hierarchy 1 in a receiving side as a result of the transmission in F508, a resending demand of a hierarchy 1 will be given to a transmitting side. Here, since the error is not produced on a hierarchy 2, in F509, the new cel P16 and a cel P17 are again written for a cel P14 in a hierarchy 1 at writing, a hierarchy 2, and a hierarchy 3.

[0088] Supposing an error arises to a hierarchy 1 and a hierarchy 2 in a receiving side as a result of the transmission in F509, a resending demand of a hierarchy 1 and a hierarchy 2 will be given to a transmitting side. Here, since the error is produced also to the hierarchy 2 in addition to the hierarchy 1, in F510, the cel P14 which transmitted the cel P16 transmitted on the hierarchy 2 last time to the hierarchy 1 on the hierarchy 1 writing and last time is written in a hierarchy 3. Moreover, the new cel P18 is written in the vacant hierarchy 2.

[0089] Thus, if resending is repeated even when a condition with an inferior circuit continues for a long time by transmitting on a hierarchy who does rotation of the hierarchy at the time of resending, and is different from last time, a cel can be transmitted on a hierarchy with the automatic highest quality, the probability of re-resending is reduced, and a cel waste ratio can be reduced.

[0090] In addition, in the gestalt 2 of operation, there is no limit in the number of hierarchies, or a control algorithm. Moreover, although every one hierarchy who writes a cel at every resending is raised with the gestalt 2 of operation, other control, such as raising the hierarchy who writes in the cel to resend to a hierarchy 1 unconditionally, can also be performed.

[0091] (Gestalt 3 of operation) Drawing 6 is the block diagram showing the partial configuration of the radio communication equipment in the gestalt 3 of operation of this invention. Drawing 6 (a) shows the configuration of the hierarchy modulator of a radio communication equipment, and drawing 6 (b) shows the configuration of the hierarchy demodulator of a radio communication equipment.

[0092] The hierarchy modulator 103 shown in drawing 6 (a) possesses two or more diffusers 601, 602, and 603 which perform diffusion process, the adder 604 adding the diffusion signal outputted from each diffuser, and the modulator 605 which modulates the added diffusion signal.

[0093] Moreover, the hierarchy demodulator 123 shown in drawing 6 (b) possesses the RAKE receivers 654, 655, and 656 which carry out RAKE composition of the output of two or more back-diffusion-of-electrons machines 651, 652, and 653 which perform back-diffusion-of-electrons processing, and each back-diffusion-of-electrons machine.

[0094] A diffuser 601 performs diffusion process using the diffusion sign A to the cel which was able to be distributed to the hierarchy 1, and amplifies a diffusion signal based on the level-setting signal A. Similarly, a diffuser 602 performs diffusion process using the diffusion sign B to the cel which was able to be distributed to the hierarchy 2, and amplifies a diffusion signal based on the level-setting signal B. Moreover, a diffuser 603 performs diffusion process using the diffusion sign C to the cel which was able to be distributed to the hierarchy 3, and amplifies a diffusion signal based on the level-setting signal C.
[0095] Here, since a quality difference is given to each hierarchy, the level-setting signal A, the level-setting signal B, and the level-setting signal C specify level different, respectively. In addition, the diffusion sign A, the diffusion sign B, and the diffusion sign C have an orthogonality mutually.
[0096] After the diffusion signal outputted from each diffuser is added with an adder 604, it becomes irregular with a modulator 605 and it is outputted from the hierarchy modulator 103 as a hierarchy modulation output.
[0097] The back-diffusion-of-electrons machine 651 performs the back diffusion of electrons with the same diffusion sign A with having used for the diffusion process of a diffuser 601 to the inputted signal, and takes out the cel which was able to be distributed to the hierarchy 1. The RAKE composition machine 654 carries out RAKE composition of the cel outputted from the back-diffusion-of-electrons machine 651.
[0098] Similarly, the back-diffusion-of-electrons machine 652 performs the back diffusion of electrons with the same diffusion sign B with having used for the diffusion process of a diffuser 602 to the inputted signal, and takes out the cel which was able to be distributed to the hierarchy 2. The RAKE composition machine 655 carries out RAKE composition of the cel outputted from the back-diffusion-of-electrons machine 652.
[0099] Moreover, the back-diffusion-of-electrons machine 653 performs the back diffusion of electrons with the same diffusion sign C with having used for the diffusion process of a diffuser 603 to the inputted signal, and takes out the cel which was able to be distributed to the hierarchy 3. The RAKE composition machine 656 carries out RAKE composition of the cel outputted from the back-diffusion-of-electrons machine 653.
[0100] Thereby, in the radio communications system of a CDMA method, a data transmission rate can be automatically changed in accordance with a circuit situation, without delivering rate selection information between a transmitting side and a receiving side.
[0101] (Gestalt 4 of operation) Drawing 7 is the block diagram showing the partial configuration of the radio communication equipment in the gestalt 4 of operation of this invention. Drawing 7 (a) shows the configuration of the hierarchy modulator of a radio communication equipment, and drawing 7 (b) shows the configuration of the hierarchy demodulator of a radio communication equipment.
[0102] The hierarchy modulator 103 shown in drawing 7 (a) possesses two or more modulators 701, 702, and 703 modulated using a respectively different subcarrier, and the adder 704 adding the modulating signal outputted from each modulator.
[0103] Moreover, the hierarchy demodulator 123 shown in drawing 7 (b) possesses two or more demodulators 751, 752, and 753 which perform recovery processing.
[0104] A modulator 701 performs modulation processing using Subcarrier A to the cel which was able to be distributed to the hierarchy 1, and amplifies the modulated signal based on the level-setting signal A. Similarly, a modulator 702 performs modulation processing using Subcarrier B to the cel which was able to be distributed to the hierarchy 2, and amplifies the modulated signal based on the level-setting signal B. Moreover, a modulator 703 performs modulation processing using Subcarrier C to the cel which was able to be distributed to the hierarchy 3, and amplifies the modulated signal based on the level-setting signal C.
[0105] Here, since a quality difference is given to each hierarchy, the level-setting signal A, the level-setting signal B, and the level-setting signal C specify level different, respectively. In addition, in order to perform multi-carrier transmission, Subcarrier A, Subcarrier B, and Subcarrier C specify a different subcarrier so that an orthogonality may be kept mutual.
[0106] The signal outputted from each modulator is added with an adder 704, and is outputted

from the hierarchy modulator 103 as a hierarchy modulation output.
[0107] To the inputted signal, a demodulator 751 performs recovery processing by the same subcarrier A as modulation processing of a modulator 701, and takes out the cel which was able to be distributed to the hierarchy 1. Similarly, to the inputted signal, a demodulator 752 performs recovery processing by the same subcarrier B as modulation processing of a modulator 702, and takes out the cel which was able to be distributed to the hierarchy 2. Moreover, to the inputted signal, a demodulator 753 performs recovery processing by the same subcarrier C as modulation processing of a modulator 703, and takes out the cel which was able to be distributed to the hierarchy 3.
[0108] Thereby, in the radio communications system of a multi-carrier method, a data transmission rate can be automatically changed in accordance with a circuit situation, without delivering rate selection information between a transmitting side and a receiving side. Moreover, radio can be performed by giving orthogonality relation to each frequency in OFDM which is a kind of a multi-carrier method.
[0109] (Gestalt 5 of operation) Drawing 8 is the block diagram showing the partial configuration of the radio communication equipment in the gestalt 5 of operation of this invention. Drawing 8 (a) shows the configuration of the hierarchy modulator of a radio communication equipment, and drawing 8 (b) shows the configuration of the hierarchy demodulator of a radio communication equipment.
[0110] The hierarchy modulator 103 shown in drawing 8 (a) possesses two or more mapping machines 801, 802, and 803 which perform respectively different mapping processing, the connection switches 804, 805, and 806 which adjust the output timing of each mapping machine, the adder 807 adding the mapped signal, and the modulator 808 which modulates the added signal.
[0111] Moreover, the hierarchy demodulator 123 shown in drawing 8 (b) possesses two or more demodulators 851, 852, and 853 which perform recovery processing.
[0112] The mapping machine 801 performs mapping by the BPSK modulation to the cel which was able to be distributed to the hierarchy 1. Similarly, the mapping machine 802 performs mapping by the QPSK modulation to the cel which was able to be distributed to the hierarchy 2. Moreover, the mapping machine 803 maps using Subcarrier C to the cel which was able to be distributed to the hierarchy 3.
[0113] After the output of each mapping machine is outputted to an adder 807 by the control to the connection switches 804, 805, and 806 of timing signal A, timing signal B, and timing signal C and is added to different time amount with an adder 807, it becomes irregular with a modulator 808 and it is outputted from the hierarchy modulator 103 as a hierarchy modulation output.
[0114] Thus, the signal from which quality differs by time amount can be transmitted by outputting the signal with which mapping differs to different time amount.
[0115] To the inputted signal, a demodulator 851 performs recovery processing using timing signal A, and takes out the cel which was able to be distributed to the hierarchy 1. Similarly, to the inputted signal, a demodulator 852 performs recovery processing using timing signal B, and takes out the cel which was able to be distributed to the hierarchy 2. Moreover, to the inputted signal, a demodulator 853 performs recovery processing using timing signal C, and takes out the cel which was able to be distributed to the hierarchy 3.
[0116] Thereby, in the radio communication equipment of a TDMA method, a data transmission rate can be automatically changed in accordance with a circuit situation, without delivering rate selection information between a transmitting side and a receiving side.
[0117] (Gestalt 6 of operation) Drawing 9 is the block diagram showing the partial configuration of the radio communication equipment in the gestalt 6 of operation of this invention. Drawing 9 (a) shows the configuration of the hierarchy modulator of a radio communication equipment, and drawing 9 (b) shows the configuration of the hierarchy demodulator of a radio communication equipment.
[0118] The hierarchy modulator 103 shown in drawing 9 (a) possesses two or more diffusers 901, 902, and 903 which perform diffusion process, the connection switches 904, 905, and 906 which adjust the output timing of each diffuser, the adder 907 adding each diffusion signal, and the

modulator 908 which modulates the added diffusion signal.
[0119] Moreover, the hierarchy demodulator 123 shown in drawing 9 (b) possesses the RAKE receivers 954, 955, and 956 which carry out RAKE composition of the output of two or more back-diffusion-of-electrons machines 951, 952, and 953 which perform back-diffusion-of-electrons processing, and each back-diffusion-of-electrons machine.
[0120] A diffuser 901 performs diffusion process using the diffusion sign A to the cel which was able to be distributed to the hierarchy 1, and amplifies a diffusion signal based on the level-setting signal A. Similarly, a diffuser 902 performs diffusion process using the diffusion sign B to the cel which was able to be distributed to the hierarchy 2, and amplifies a diffusion signal based on the level-setting signal B. Moreover, a diffuser 903 performs diffusion process using the diffusion sign C to the cel which was able to be distributed to the hierarchy 3, and amplifies a diffusion signal based on the level-setting signal C.
[0121] Here, since a quality difference is given to each hierarchy, the diffusion sign A, the diffusion sign B, and the diffusion sign C have a diffusion coefficient different, respectively. Moreover, since a quality difference is given to each hierarchy, the level-setting signal A, the level-setting signal B, and the level-setting signal C may use specifying level different, respectively together. A fixed then signal with a larger diffusion coefficient is more nearly quality in all transmission levels.
[0122] After the diffusion signal outputted from each diffuser is outputted to an adder by the control to the connection switches 904, 905, and 906 of timing signal A, timing signal B, and timing signal C and is added to different time amount with an adder 907, it becomes irregular with a modulator 908 and it is outputted from the hierarchy modulator 103 as a hierarchy modulation output.
[0123] Thus, the signal from which quality differs by time amount can be transmitted by outputting the signal with which diffusion coefficients differ to different time amount.
[0124] The back-diffusion-of-electrons machine 951 performs the back diffusion of electrons with the same diffusion sign A with having used for the diffusion process of a diffuser 901 to the inputted signal, and takes out the cel which was able to be distributed to the hierarchy 1. The RAKE composition machine 954 carries out RAKE composition of the cel outputted from the back-diffusion-of-electrons machine 951. Similarly, the back-diffusion-of-electrons machine 952 performs the back diffusion of electrons with the same diffusion sign B with having used for the diffusion process of a diffuser 902 to the inputted signal, and takes out the cel which was able to be distributed to the hierarchy 2. The RAKE composition machine 955 carries out RAKE composition of the cel outputted from the back-diffusion-of-electrons machine 952. Moreover, the back-diffusion-of-electrons machine 953 performs the back diffusion of electrons with the same diffusion sign C with having used for the diffusion process of a diffuser 903 to the inputted signal, and takes out the cel which was able to be distributed to the hierarchy 3. The RAKE composition machine 956 carries out RAKE composition of the cel outputted from the back-diffusion-of-electrons machine 953.
[0125] Thereby, in the radio communications system of a CDMA method, a data transmission rate can be automatically changed and introduced in accordance with a circuit situation, without delivering rate selection information between a transmitting side and a receiving side.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram showing the configuration of the radio communication equipment in the gestalt 1 of operation of this invention
[Drawing 2] The mimetic diagram showing signal point arrangement of the hierarchy modulation in a QPSK modulation
[Drawing 3] The block diagram showing the configuration of the radio communication equipment in the gestalt 2 of operation
[Drawing 4] The flow Fig. showing processing actuation of the transmission-control machine of the radio communication equipment in the gestalt 2 of operation
[Drawing 5] The mimetic diagram showing the cel written in the TMP buffer of each hierarchy of the radio communication equipment in the gestalt 2 of operation
[Drawing 6] The block diagram showing the partial configuration of the radio communication equipment in the gestalt 3 of operation
[Drawing 7] The block diagram showing the partial configuration of the radio communication equipment in the gestalt 4 of operation
[Drawing 8] The block diagram showing the partial configuration of the radio communication equipment in the gestalt 5 of operation
[Drawing 9] The block diagram showing the partial configuration of the radio communication equipment in the gestalt 6 of operation
[Drawing 10] The block diagram showing the configuration of the radio communication equipment which performs the adaptation modulation in the conventional TDD transmission
[Drawing 11] The block diagram showing the configuration of the radio communication equipment which performs the adaptation modulation in the conventional FDD transmission
[Description of Notations]
101 Encoder
102 Data Buffer
103 Hierarchy Modulator
104 Amplifier
106 Amplifier
107 Demodulator
152 Amplifier
153 Hierarchy Demodulator
154, 155, 156 Error detection machine
157 Data Buffer
158 Modulator
159 Amplifier
301 Transmission-Control Machine
302, 303, 304 TMP buffer

[Translation done.]

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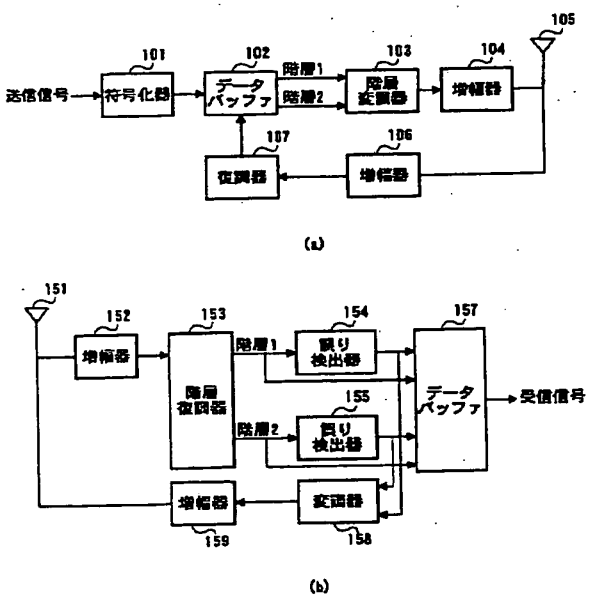
(54)【発明の名称】　送信装置並びに受信装置及びデータ伝送方法

(57)【要約】
【課題】　送信側と受信側とでレート選択情報を受け渡しすることなく、回線に応じて自動的にデータ伝送レートを適応制御し、データの伝送効率を向上させる。
【解決手段】　送信側で、符号化器１０１にて、送信信号をセル毎に複数の階層に振り分け、階層毎に誤り検出できるように符号化処理を行い、データバッファ１０２に蓄えた後、階層変調器１０３にて、それぞれが異なる品質になるような階層変調を施して送信する。受信側で、階層復調器１２３にて、階層復調を行い、各階層毎にセルを取り出し、誤り検出器１２４、１２５にて、階層毎に誤り検出を行い、誤りの検出されたセルに関する再送要求信号を出す。送信側は再送要求のあったセルのみを再送する。



【特許請求の範囲】

【請求項１】　送信信号をセル単位で複数の階層に振り分けて階層毎に誤り検出用の符号化を行う符号化手段と、符号化されたセルを蓄積し、再送要求がない場合に新規セルを出力し、再送要求があった場合に当該セルを再出力する送信制御手段と、この送信制御手段から出力されたセルに対し階層変調を行う階層変調手段とを具備することを特徴とする送信装置。

【請求項２】　送信制御手段は、符号化されたセルを蓄積する第１バッファと、第１バッファに書き込まれたセルの階層を制御する階層制御手段と、この階層制御手段により制御されたセルを階層毎に蓄積する第２バッファとを具備することを特徴とする請求項１記載の送信装置。

【請求項３】　階層制御手段は、再送要求があったセルを前回と異なる階層で再出力することを特徴とする請求項２記載の送信装置。

【請求項４】　階層変調手段は、階層毎に異なる符号で拡散し、異なる送信レベルで出力する拡散手段と、この拡散手段の出力を加算する加算手段と、この加算手段の出力を変調する変調手段とを具備することを特徴とする請求項１乃至請求項３のいずれかに記載の送信装置。

【請求項５】　拡散手段は、階層毎に異なる拡散率の符号で拡散し、異なるタイミングで出力することを特徴とする請求項４記載の送信装置。

【請求項６】　階層変調手段は、階層毎に異なる周波数で変調し、異なる送信レベルで出力するキャリア変調手段と、このキャリア変調手段の出力を加算する加算手段とを具備することを特徴とする請求項１乃至請求項３のいずれかに記載の送信装置。

【請求項７】　キャリア変調手段は、各周波数が直交関係を有するように変調することを特徴とする請求項６記載の送信装置。

【請求項８】　階層変調手段は、階層毎に異なるマッピング処理を行い、異なるタイミングで出力するマッピング手段と、このマッピング手段の出力を加算する加算手段と、この加算手段の出力を変調する変調手段とを具備することを特徴とする請求項１乃至請求項３のいずれかに記載の送信装置。

【請求項９】　送信側にて階層変調された信号を復調し、各階層のセルを取り出す階層復調手段と、各階層毎にセルの誤り検出を行う誤り検出手段と、誤りを検出したセルに関する再送要求信号を送信する再送要求送信手段とを具備することを特徴とする受信装置。

【請求項１０】　階層復調手段は、送信側の拡散処理と同じ符号で逆拡散して、各階層のセルを取り出す逆拡散手段と、各階層のセルをＲＡＫＥ合成するＲＡＫＥ合成手段とを具備することを特徴とする請求項９記載の受信装置。

【請求項１１】　階層復調手段は、送信側の変調処理と同じ周波数で復調し、各階層のセルを取り出す復調手段を具備することを特徴とする請求項９記載の受信装置。

【請求項１２】　階層復調手段は、送信側のマッピング処理と同じタイミングで復調し、各階層のセルを取り出す復調手段を具備することを特徴とする請求項９記載の受信装置。

【請求項１３】　請求項１乃至請求項８のいずれかに記載の送信装置を搭載して無線通信を行うことを特徴とする通信端末装置。

【請求項１４】　請求項９乃至請求項１２のいずれかに記載の受信装置を搭載し、請求項記載１３記載の通信端末装置と無線通信を行うことを特徴とする基地局装置。

【請求項１５】　請求項１乃至請求項８のいずれかに記載の送信装置を搭載して無線通信を行うことを特徴とする基地局装置。

【請求項１６】　請求項９乃至請求項１２のいずれかに記載の受信装置を搭載し、請求項１５記載の基地局装置と無線通信を行うことを特徴とする通信端末装置。

【請求項１７】　請求項１３記載の通信端末装置と請求項１４記載の基地局装置とにより無線通信を行うことを特徴とする無線通信システム。

【請求項１８】　請求項１６記載の通信端末装置と請求項１５記載の基地局装置とにより無線通信を行うことを特徴とする無線通信システム。

【請求項１９】　送信側にて、送信信号をセル単位で複数の階層に振り分けて階層毎に誤り検出用の符号化を行い、符号化されたセルに対し階層変調を行い、受信側にて、階層変調された信号を復調して各階層のセルを取り出し、各階層毎にセルの誤り検出を行うことを特徴とするデータ伝送方法。

【請求項２０】　受信側にて、誤りを検出したセルに関する再送要求信号を送信し、送信側にて、再送要求がない場合に新規セルを出力し、再送要求があった場合に当該セルを再出力することを特徴とする請求項１９記載のデータ伝送方法。

【請求項２１】　再送要求があったセルを前回と異なる階層で再出力することを特徴とする請求項１９又は請求項２０記載のデータ伝送方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、無線通信装置に搭載され、回線状況に応じてデータ伝送レートを変化させる送信装置並びに受信装置及びデータ伝送方法に関する。

【０００２】

【従来の技術】無線通信システムにおいて、回線状況に応じてデータ伝送レートを適応的に制御し、データの平均伝送効率を高めるデータ伝送方法を採用する場合がある。

【０００３】以下、従来のデータ伝送レートを適応制御

する無線通信装置について、図面を用いて説明する。

【０００４】図１０は、従来のＴＤＤ伝送方式における無線通信装置の構成を示すブロック図である。図１０（ａ）は、データ伝送レートを適応制御してデータを送信する側（以下、「送信側」という）の構成を示すブロック図であり、図１０（ｂ）は、データ伝送レートを適応制御されたデータを受信する側（以下、「受信側」という）の構成を示すブロック図である。

【０００５】図１０（ａ）に示す無線通信装置の送信側は、送信信号を一時的に蓄えるデータバッファ１と、送信信号に対してＢＰＳＫ変調を行う変調器２と、送信信号に対してＱＰＳＫ変調を行う変調器３と、送信信号に対して１６ＡＭ変調を行う変調器４と、変調された信号を増幅する増幅器５と、信号を無線送受するアンテナ６と、アンテナ６から受信された信号のレベルを測定するレベル測定器７と、受信信号レベルからデータ伝送レートを選択し、データ伝送レートを示すレート選択情報を生成するレート選択器８と、レート選択器８により切替え制御されるスイッチ９、１０とから主に構成される。

【０００６】また、図１０（ｂ）に示す無線通信装置の受信側は、信号を無線送受するアンテナ２１と、受信信号を増幅する増幅器２２と、受信信号に対してＢＰＳＫ復調を行う復調器２３と、受信信号に対してＱＰＳＫ復調を行う復調器２４と、受信信号に対して１６ＱＡＭ復調を行う復調器２５と、復調された信号を蓄えるデータバッファ２６と、受信信号をＢＰＳＫ復調してレート選択情報を抽出するＢＰＳＫ復調器２７と、ＢＰＳＫ復調器２７の出力からデータ伝送レートを検出するレート検出器２８と、レート検出器２８により切替え制御されるスイッチ２９、３０とから主に構成される。

【０００７】ＴＤＤ伝送方式の場合、上り回線と下り回線の伝搬路が同一であるので、送信側にて受信信号のレベルを測定し、その受信信号のレベルに基づき送信信号の変調方式を選択することができる。

【０００８】送信側のレート選択器８は、受信信号のレベルが大きい場合に回線状況が良いと判断し、誤りやすいがデータ伝送レートの高い１６ＱＡＭ等の変調方式を選択してスイッチ９、１０を制御し、レベルが低い場合に回線状況が悪いと判断し、データ伝送レートは低いが誤りにくいＢＰＳＫ等の変調方式を選択してスイッチ９、１０を制御する。更に、レート選択器８は、レート選択情報をデータバッファ１に格納する。

【０００９】データバッファ１に格納された送信信号は、レート選択器８で選択された変調方式で変調される。ただし、レート選択情報は、誤りを生じにくくするため、常に、ＢＰＳＫ方式で変調される。変調された信号は、増幅器５にて増幅された後、アンテナ６から無線送信される。

【００１０】受信側のアンテナ２１に受信された信号は、増幅器２２で増幅された後、ＢＰＳＫ復調器２７でレート選択情報が抽出され、レート検出器２８でデータ伝送レートが検出される。そして、検出されたデータ伝送レートに基き、スイッチ２９、３０が切替制御され、受信信号は、変調方式と同じデータ伝送レートの復調方式で復調される。復調結果は、データバッファ２６に格納された後、受信信号として取り出される。

【００１１】図１１は、従来のＦＤＤ伝送方式における無線通信装置の構成を示すブロック図である。図１１（ａ）は送信側の構成を示し、図１１（ｂ）は受信側の構成を示す。なお、図１１において、図１０と同様の構成要素については、図１０と同一符号を付して説明を省略する。

【００１２】ＦＤＤ伝送方式の場合、上り回線と下り回線の伝搬路が異なるので、受信側にて、受信信号のレベルを測定し、受信信号のレベルに基づき送信信号の変調方式を選択する。

【００１３】図１０と比較して図１１に示す無線通信装置の送信側は、レベル測定器７及びレート選択器８の代りに、受信信号を増幅する増幅器１１と、受信信号からレート選択情報を抽出する復調器１２と、レート選択情報からデータ伝送レートを検出するレート検出器１３を具備する。

【００１４】また、受信側は、ＢＰＳＫ復調器２７及びレート選択器２８の代りに、受信信号レベルを測定するレベル測定器３１と、受信レベルからデータ伝送レートを選択し、データ伝送レートを示すレート選択情報を生成するレート選択器３２と、レート選択情報を変調する変調器３３と、変調されたレート選択情報を増幅する増幅器３４を具備する。

【００１５】受信側のレート選択器３２は、受信信号のレベルが大きい場合に回線状況が良好と判断し、誤りやすいがデータ伝送レートの高い１６ＱＡＭ等の変調方式を選択し、レート選択情報を変調器３３に出力する。また、レート選択器３２は、受信信号のレベルが小さい場合に回線状況が劣悪と判断し、データ伝送レートは低いが誤りにくいＢＰＳＫ等の変調方式を選択し、レート選択情報を変調器３３に出力する。レート選択情報は、変調器３３にて、誤りが生じにくい変調方式であるＢＰＳＫ方式で変調され、増幅器３４にて増幅された後、アンテナ２１から送信側に送信される。

【００１６】また、レート選択器３２は、レート選択情報を出力すると同時に、スイッチ２９、３０を制御して、指定したデータ伝送レートに対応する復調を行う準備をする。復調結果は、データバッファ２６に格納された後、受信信号として取り出される。

【００１７】送信側のアンテナ６に受信された信号は、増幅器１１にて増幅された後、復調器１２にて復調され、レート選択情報が抽出される。そして、レート検出器１３にて、レート選択情報からデータ伝送レートが検出され、スイッチ９、１０が制御され、送信信号のデー

タ伝送レートが決定される。

【００１８】送信信号は、一旦データバッファ１に蓄えられ、レート検出器１３の制御に従って、ＢＰＳＫ変調器２、ＱＰＳＫ変調器３、１６ＱＡＭ変調器４のいずれかにて変調され、増幅器５で増幅された後、アンテナ６から受信側に送信される。

【００１９】このように、従来のデータ伝送レートを適応制御する無線通信装置は、回線状況が良好な場合にデータ伝送レートの高い変調方式を使用して伝送効率を向上させ、回線状況が劣悪な場合にデータ伝送レートは低いが誤りにくい変調方式を使用して確実にデータを伝送させることにより、データの平均伝送効率を高めている。

【００２０】

【発明が解決しようとする課題】しかしながら、上記従来の無線通信装置は、送信側と受信側とでレート選択情報の受け渡しを行わねばならず、レート選択情報が誤った場合、却って伝送効率が落ちてしまうという課題を有する。また、マルチパスフェージングが起こる場合、回線状況の判断材料として、受信レベルだけでは不十分であり、受信品質の推定精度が悪くなるという課題を有する。更に、フェージング速度が速い場合、レート選択時点と信号送信時点の回線状況が変化するため、伝送効率を十分に向上できないという課題を有する。

【００２１】本発明は、かかる点に鑑みてなされたものであり、レート選択情報の受け渡しを行うことなく、回線状況にあわせて自動的にデータ伝送レートを切替える送信装置並びに受信装置及びデータ伝送方法を提供することを目的とする。

【００２２】

【課題を解決するための手段】上記課題を解決するために本発明は、送信側にて、送信信号をセル単位で複数の階層に振り分け、階層毎に誤り検出できる符号化処理を行い、階層変調して送信し、受信側にて、受信信号を復調して階層毎に誤り検出を行い、階層毎に再送要求を行う手段を講じた。

【００２３】

【発明の実施の形態】本発明の第１の態様における送信装置の発明は、送信信号をセル単位で複数の階層に振り分けて階層毎に誤り検出用の符号化を行う符号化手段と、符号化されたセルを蓄積し、再送要求がない場合に新規セルを出力し、再送要求があった場合に当該セルを再出力する送信制御手段と、この送信制御手段から出力されたセルに対し階層変調を行う階層変調手段とを具備する構成を採る。

【００２４】また、本発明の第９の態様における受信装置の発明は、送信側にて階層変調された信号を復調し、各階層のセルを取り出す階層復調手段と、各階層毎にセルの誤り検出を行う誤り検出手段と、誤りを検出したセルに関する再送要求信号を送信する再送要求送信手段とを具備する構成を採る。

【００２５】また、本発明の第１９の態様におけるデータ伝送方法の発明は、送信側にて、送信信号をセル単位で複数の階層に振り分けて階層毎に誤り検出用の符号化を行い、符号化されたセルに対し階層変調を行い、受信側にて、階層変調された信号を復調して各階層のセルを取り出し、各階層毎にセルの誤り検出を行う方法を採る。

【００２６】また、本発明の第２０の態様における発明は、第１９の態様におけるデータ伝送方法において、受信側にて、誤りを検出したセルに関する再送要求信号を送信し、送信側にて、再送要求がない場合に新規セルを出力し、再送要求があった場合に当該セルを再出力する方法を採る。

【００２７】ここで、階層変調とは、信号点配置の工夫等により、同一回線で送信された複数の信号の品質に差をつけて変調する方式である。

【００２８】これらの構成により、送信側にて、送信信号をセル単位で複数の階層に振り分け、階層毎に誤り検出ができる符号化処理を施して階層変調を行い、受信側にて、階層毎に誤り検出を行うことができ、レート選択情報の受け渡しを行うことなく、回線状況に合わせて自動的にデータ伝送レートを適応制御できる。

【００２９】また、本発明の第２の態様における発明は、第１の態様における送信装置において、送信制御手段は、符号化されたセルを蓄積する第１バッファと、第１バッファに書き込まれたセルの階層を制御する階層制御手段と、この階層制御手段により制御されたセルを階層毎に蓄積する第２バッファとを具備する構成を採る。

【００３０】また、本発明の第３の態様における発明は、第２の態様における送信装置において、階層制御手段は、再送要求があったセルを前回と異なる階層で再出力する構成を採る。

【００３１】また、本発明の第２１の態様における発明は、第１９の態様又は第２０の態様のデータ伝送方法において、再送要求があったセルを前回と異なる階層で再出力する方法を採る。

【００３２】これらの構成により、再送時に前回の階層と異なる階層にて送信するため、回線が劣悪な状態が長時間続く場合でも、再送を繰り返せば、自動的に最も品質が高い階層でセルを送信することができ、再再送の確率を低減してセル廃棄率を低減できる。

【００３３】また、本発明の第４の態様における発明は、第１の態様乃至第３の態様のいずれかの送信装置において、階層変調手段は、階層毎に異なる符号で拡散し、異なる送信レベルで出力する拡散手段と、この拡散手段の出力を加算する加算手段と、この加算手段の出力を変調する変調手段とを具備する構成を採る。

【００３４】また、本発明の第５の態様における発明は、第４の態様の送信装置において、拡散手段は、階層

毎に異なる拡散率の符号で拡散し、異なるタイミングで出力する構成を採る。

【００３５】また、本発明の第１０の態様における発明は、第９の態様の受信送信装置において、階層復調手段は、送信側の拡散処理と同じ符号で逆拡散して、各階層のセルを取り出す逆拡散手段と、各階層のセルをＲＡＫＥ合成するＲＡＫＥ合成手段とを具備する構成を採る。

【００３６】これらの構成により、ＣＤＭＡ方式の無線通信システムにおいて、送信側と受信側との間でレート選択情報を受け渡しすることなく回線状況にあわせて自動的にデータ伝送レートを切替えることができる。

【００３７】また、本発明の第６の態様における発明は、第１の態様乃至第３の態様のいずれかの送信装置において、階層変調手段は、階層毎に異なる周波数で変調し、異なる送信レベルで出力するキャリア変調手段と、このキャリア変調手段の出力を加算する加算手段とを具備する構成を採る。

【００３８】また、本発明の第１１の態様における発明は、第９の態様の受信送信装置において、階層復調手段は、送信側の変調処理と同じ周波数で復調し、各階層のセルを取り出す復調手段を具備する構成を採る。

【００３９】これらの構成により、マルチキャリア方式の無線通信システムにおいて、送信側と受信側との間でレート選択情報を受け渡しすることなく回線状況にあわせて自動的にデータ伝送レートを切替えることができる。

【００４０】また、本発明の第７の態様における発明は、第６の態様の送信装置において、キャリア変調手段は、各周波数が直交関係を有するように変調する構成を採る。

【００４１】この構成により、マルチキャリア方式の一種であるＯＦＤＭを用いる無線通信システムにおいて、送信側と受信側との間でレート選択情報を受け渡しすることなく回線状況にあわせて自動的にデータ伝送レートを切替えることができる。

【００４２】また、本発明の第８の態様における発明は、第１の態様乃至第３の態様のいずれかの送信装置において、階層変調手段は、階層毎に異なるマッピング処理を行い、異なるタイミングで出力するマッピング手段と、このマッピング手段の出力を加算する加算手段と、この加算手段の出力を変調する変調手段とを具備する構成を採る。

【００４３】また、本発明の第１２の態様における発明は、第９の態様の受信送信装置において、階層復調手段は、送信側のマッピング処理と同じタイミングで復調し、各階層のセルを取り出す復調手段を具備する構成を採る。

【００４４】これらの構成により、ＴＤＭＡ方式の無線通信装置において、送信側と受信側との間でレート選択情報を受け渡しすることなく回線状況にあわせて自動的にデータ伝送レートを切替えることができる。

【００４５】また、本発明の第１３の態様における通信端末装置の発明は、請求項１乃至請求項８のいずれかに記載の送信装置を搭載して無線通信を行う構成を採る。なお、通信端末装置には、移動通信システムにおける移動局装置を含む。

【００４６】また、本発明の第１４の態様における基地局装置の発明は、請求項９乃至請求項１２のいずれかに記載の受信装置を搭載し、請求項記載１３記載の通信端末装置と無線通信を行う構成を採る。

【００４７】また、本発明の第１５の態様における基地局装置の発明は、請求項１乃至請求項８のいずれかに記載の送信装置を搭載して無線通信を行う構成を採る。

【００４８】また、本発明の第１６の態様における通信端末装置の発明は、請求項９乃至請求項１２のいずれかに記載の受信装置を搭載し、請求項１５記載の基地局装置と無線通信を行う構成を採る。

【００４９】また、本発明の第１７の態様における無線通信システムの発明は、請求項１３記載の通信端末装置と請求項１４記載の基地局装置とにより無線通信を行う構成を採る。

【００５０】また、本発明の第１８の態様における無線通信システムの発明は、請求項１６記載の通信端末装置と請求項１５記載の基地局装置とにより無線通信を行う構成を採る。

【００５１】以下、本発明の実施の形態について、添付図面を参照して詳細に説明する。

（実施の形態１）図１は、本発明の実施の形態１における無線通信装置の構成を示すブロック図である。図１（ａ）は、データを階層変調して送信する側（以下、「送信側」という）を示し、図１（ｂ）は、階層変調されたデータを受信する側（以下、「受信側」という）を示す。

【００５２】図１（ａ）に示す無線通信装置の送信側は、送信信号に対し誤り検出用の符号化を行う符号化器１０１と、符号化された送信信号を一時的に格納するデータバッファ１０２と、符号化された信号に対し階層変調を行う階層変調器１０３と、階層変調された信号を増幅する増幅器１０４と、信号を送受信するアンテナ１０５と、受信側からの再送要求信号を増幅する増幅器１０６と、再送要求信号を復調する復調器１０７とから主に構成される。

【００５３】図１（ｂ）に示す受信側は、信号を送受信するアンテナ１５１と、受信信号を増幅する増幅器１５２と、増幅された受信信号に対し階層復調を行う階層復調器１５３と、受信信号の誤りを検出する誤り検出器１５４、１５５と、受信信号を一時的に格納するデータバッファ１５７と、再送要求信号を変調する変調器１５８と、再送要求信号を増幅する増幅器１５９とから主に構成される。

【００５４】送信側の符号化器１０１は、送信信号をセル単位で複数の階層に振り分け、階層毎に誤り検出ができるように符号化を行い、データバッファ１０２に格納する。各階層に振り分けられたセルは、階層変調器１０３にて階層変調され、増幅器１０４にて増幅され、アンテナ１０５から送信される。

【００５５】以下、階層変調について、図２に示すＱＰＳＫ変調の信号点配置を示す図を用いて説明する。図２（ａ）は、通常のＱＰＳＫ変調の信号点配置を示し、Ｉ成分の信号点間の距離２０１とＱ成分の信号点間の距離２０２が等しいため、Ｉ成分の品質はＱ成分の品質と同じである。図２（ｂ）は、階層変調処理を施したＱＰＳＫ変調の信号点配置を示し、Ｉ成分の信号点間距離２５１がＱ成分の信号点間距離２５２より長いので、Ｉ成分の品質の方がＱ成分の品質より良い。また、図２（ｂ）は図２（ａ）に対し、Ｑ成分の品質は悪いがＩ成分の品質は良い。

【００５６】アンテナ１５１で受信された信号は、増幅器１５２にて増幅され、階層復調器１５３にて階層復調され、各階層のセルが取り出される。階層変調されたセルは、誤り検出器１５４、１５５にて、階層毎に誤り検出処理され、誤りが検出されたセルに関する再送要求信号が出力される。再送要求信号は、変調器１５８にて変調され、増幅器１５９にて増幅され、アンテナ１５１から送信される。

【００５７】受信側から送信された再送要求信号は、アンテナ１０５及び増幅器１０６を経由し、復調器１０７にて検出され、データバッファ１０２に出力される。そして、再送要求があったセルは、自動的に再度データバッファ１０２から読み出されて再送される。

【００５８】例えば、図１における階層１を図２（ｂ）に示すＩ成分とし、図１における階層２を図２（ｂ）に示すＱ成分とすると、回線状態が劣悪な場合でも、品質が高い階層１はデータ伝送に成功できるので、１シンボル当たり１ビットのデータ伝送レートであるＢＰＳＫ並の伝送効率を確保できる。なお、階層２から送信されたセルは、データ伝送に成功するまで再送が繰り返される。ただし、再送回数がバッファサイズを超えた場合、当該セルは廃棄される。

【００５９】一方、回線状況が良好な場合、階層１に加えて品質が低い階層２もデータ伝送に成功できるので、１シンボル当たり２ビットのデータ伝送レートであるＱＰＳＫ並の伝送効率を得られる。

【００６０】このように、送信側で、送信信号をセル単位で複数の階層に振り分け、階層毎に誤り検出ができる符号化処理を行って階層変調を行い、受信側で階層毎に誤り検出を行うことにより、レート選択情報の受け渡しを行うことなく、回線状況に応じて自動的にデータ伝送レートを適応制御できる。

【００６１】なお、実施の形態１では、階層が２段階の場合について説明しているが、本発明は階層の段階に制限はなく、何段階の階層を使用してもよい。

【００６２】（実施の形態２）図３は、実施の形態２における無線通信装置の構成を示すブロック図である。図３（ａ）は送信側を示し、図３（ｂ）は受信側を示す。なお、図３において、図１と同様の構成要素については、図１と同一符号を付して説明を省略する。

【００６３】図３に示す無線通信装置の送信側には、図１と比較して、送信信号の階層を制御する送信制御器３０１と、セルを一時的に格納するＴＭＰバッファ３０２、３０３、３０４とが追加される。また、説明のために、図１では階層数が２の場合を示し、図３では階層数が３の場合を示しているが、これによる根本的な構成差はない。

【００６４】送信制御器３０１は、データバッファ１０２に格納された各セルの階層を制御し、ＴＭＰバッファ３０２、３０３、３０４に格納する。また、データバッファ１０２及びＴＭＰバッファ３０２、３０３、３０４に書き込まれたセルの消去処理を行う。また、復調器１０７から再送要求信号を入力した場合、該当セルを前回と異なるＴＭＰバッファに書き込むことにより、再送するセルを前回と異なる階層で送信するように制御する。

【００６５】次に、送信制御器３０１の制御動作について、図４に示すフロー図及び図５に示す模式図を用いて説明する。なお、図４中のＩは階層数を示す。また、ｉが小さいほど品質が良好な階層であり、階層１が最も品質が良く、階層Ｉが最も品質が悪いものとする。

【００６６】まず、送信開始時に、全てのＴＭＰバッファ３０２、３０３、３０４に書き込まれたセルを消去する（ＳＴ４０１）。次に、データバッファ１０２から入力した送信セルを空いているＴＭＰバッファ３０２、３０３、３０４に書き込む（ＳＴ４０２）。なお、各ＴＭＰバッファに書き込まれたセルは、階層変調器１０３にて階層変調され、増幅器１０４にて振幅を増幅され、アンテナ１０５から無線送信される。

【００６７】送信セルの送信を完了すると（ＳＴ４０３）、全てのＴＭＰバッファ３０２、３０３、３０４に書き込まれたセルを消去する（ＳＴ４０４）。

【００６８】次に、階層２で送信したセルに対し、受信側から再送要求があったかどうかを判断する（ＳＴ４０５、ＳＴ４０６）。そして、ＳＴ４０６で該当セルに対し再送要求があった場合、当該セルの再送回数がバッファサイズを越えているかどうかを判断する（ＳＴ４０７）。

【００６９】そして、ＳＴ４０７で該当セルの再送回数がバッファサイズを越えていない場合、前回送信した階層より１ランク上げてＴＭＰバッファに書き込む（ＳＴ４０８、ＳＴ４０９）。再送するセルの階層を１ランク上げて送信することにより、再送要求を繰り返すうちに自動的に最も誤りにくい階層で送信することができるた

め、再再送の確率を低減できセル廃棄率を低減でき、送信の確実性を高くすることができる。

【００７０】また、ＳＴ４０６で該当セルに対し再送要求がない場合、又は、ＳＴ４０７でバッファサイズを越えている場合、該当セルをデータバッファ１０２から削除する（ＳＴ４１０）。

【００７１】そして、階層３から階層Ｉまでで送信したセルに対して、ＳＴ４０６からＳＴ４１０の動作を繰り返す（ＳＴ４１１、ＳＴ４１２、ＳＴ４１３）。

【００７２】次に、階層１で送信したセルに対し、受信側から再送要求があったかどうかを判断する（ＳＴ４１４、ＳＴ４０６）。そして、ＳＴ４０６で再送要求があった場合、当該セルの再送回数がバッファサイズを越えているかどうかを判断する（ＳＴ４０７）。

【００７３】そして、ＳＴ４０７で該当セルの再送回数がバッファサイズを越えていない場合、階層１のＴＭＰバッファに既にセルが書込まれているかどうかを判断する（ＳＴ４０８、ＳＴ４１５）。

【００７４】ＳＴ４１５で、階層１のＴＭＰバッファに既にセルが書込まれている場合、当該セルを階層ＩのＴＭＰバッファに書き込む（ＳＴ４１６）。

【００７５】また、ＳＴ４１５で、階層１のＴＭＰバッファが空いている場合、当該セルを階層１のＴＭＰバッファに書き込む（ＳＴ４１７）。

【００７６】また、ＳＴ４０６で再送要求がない場合、又は、ＳＴ４０７でバッファサイズを越えている場合、該当セルをデータバッファ１０２から削除する（ＳＴ４１０）。

【００７７】そして、データバッファ１０２に送信されていないセルが残っているかどうかを判断し、まだ送信されたいないセルが残っている場合、ＳＴ４０２からＳＴ４１７の動作を繰り返す。また、すべてのセルの送信を完了した場合、データ伝送を終了する（ＳＴ４１８）。

【００７８】図５は、実施の形態２における無線通信装置の各階層のＴＭＰバッファに書き込まれるセルを表した模式図である。

【００７９】まず、Ｆ５０１では、階層１にセルＰ１、階層２にセルＰ２、階層３にセルＰ３を書き込む。

【００８０】Ｆ５０１における送信の結果、受信側にて、階層３にのみ誤りが生じたとすると、送信側に階層３の再送要求が出される。Ｆ５０２では、再送要求に従ってセルＰ３を階層２に書き込む。また、空いている階層１と階層３に新規のセルＰ４とセルＰ５を書き込む。

【００８１】Ｆ５０２における送信の結果、受信側にて、全てのセルが誤りなく受信されたとすると、送信側に再送要求は出されない。よって、Ｆ５０３では、全ての階層に新規のセルＰ６、セルＰ７、セルＰ８を書き込む。

【００８２】Ｆ５０３における送信の結果、受信側にて、階層２及び階層３の両方に誤りが生じたとすると、送信側に階層２及び階層３の再送要求が出される。Ｆ５０４では、再送要求に従ってセルＰ７を階層１に書き込み、セルＰ８を階層に書き込む。また、空いている階層３にセルＰ９を書き込む。

【００８３】ここで、階層３に誤りが生じず階層３より品質がよい階層２に誤りが生じることもありうる。Ｆ５０４における送信の結果、受信側にて、階層２にのみ誤りが生じたとすると、送信側に階層２の再送要求が出される。Ｆ５０５では、再送要求に従ってセルＰ８を階層１に書き込む。また、空いている階層２と階層３に新規のセルＰ１０とセルＰ１１を書き込む。

【００８４】Ｆ５０５における送信の結果、受信側にて、全ての階層２に誤りが生じたとすると、送信側に全ての階層の再送要求が出される。Ｆ５０６では、再送要求に従ってセルＰ１０を階層１に書き込み、セルＰ１１を階層２に書き込み、セル８を階層３に書き込む。

【００８５】Ｆ５０６における送信の結果、受信側にて、階層３にのみ誤りが生じたとすると、送信側に階層３の再送要求が出される。Ｆ５０７では、再送要求に従ってセルＰ８を階層２に書き込む。また、空いている階層１と階層３に新規のセルＰ１２とセルＰ１３を書き込む。

【００８６】Ｆ５０７における送信の結果、受信側にて、階層２及び階層３に誤りが生じたとすると、送信側に階層２及び階層３の再送要求が出される。ここで、セルＰ８はバッファサイズを超える遅延となるため廃棄される。よって、Ｆ５０８では、再送要求に従ってセルＰ１３を階層２に書き込む。また、空いている階層１と階層３に新規のセルＰ１４とセルＰ１５を書き込む。

【００８７】Ｆ５０８における送信の結果、受信側にて、階層１のみに誤りが生じたとすると、送信側に階層１の再送要求が出される。ここで、階層２で誤りを生じていないため、Ｆ５０９では、セルＰ１４を再び階層１に書込み、階層２及び階層３に新規のセルＰ１６、セルＰ１７を書き込む。

【００８８】Ｆ５０９における送信の結果、受信側にて、階層１及び階層２に誤りが生じたとすると、送信側に階層１及び階層２の再送要求が出される。ここで、階層１に加えて、階層２にも誤りを生じているため、Ｆ５１０では、前回階層２で送信したセルＰ１６を階層１に書込み、前回階層１で送信したセルＰ１４を階層３に書込む。また、空いている階層２に新規のセルＰ１８を書き込む。

【００８９】このように、再送時に階層をローテーションして前回と異なる階層にて送信することにより、回線が劣悪な状態が長時間続く場合でも、再送を繰り返せば、自動的に最も品質が高い階層でセルを送信することができ、再再送の確率を低減してセル廃棄率を低減できる。

【００９０】なお、実施の形態２において、階層数や制御アルゴリズムに制限はない。また、実施の形態２では、再送の度にセルを書き込む階層を１つづつ上げているが、再送するセルを書き込む階層を無条件で階層１に上げる等、他の制御を行うこともできる。

【００９１】（実施の形態３）図６は、本発明の実施の形態３における無線通信装置の部分構成を示すブロック図である。図６（ａ）は、無線通信装置の階層変調器の構成を示し、図６（ｂ）は、無線通信装置の階層復調器の構成を示す。

【００９２】図６（ａ）に示す階層変調器１０３は、拡散処理を行う複数の拡散器６０１、６０２、６０３と、各拡散器から出力された拡散信号を加算する加算器６０４と、加算された拡散信号を変調する変調器６０５とを具備する。

【００９３】また、図６（ｂ）に示す階層復調器１２３は、逆拡散処理を行う複数の逆拡散器６５１、６５２、６５３と各逆拡散器の出力をＲＡＫＥ合成するＲＡＫＥ受信器６５４、６５５、６５６を具備する。

【００９４】拡散器６０１は、階層１に振り分けられたセルに対して拡散符号Ａを用いて拡散処理を行い、レベル設定信号Ａに基づいて拡散信号を増幅する。同様に、拡散器６０２は、階層２に振り分けられたセルに対して拡散符号Ｂを用いて拡散処理を行い、レベル設定信号Ｂに基づいて拡散信号を増幅する。また、拡散器６０３は、階層３に振り分けられたセルに対して拡散符号Ｃを用いて拡散処理を行い、レベル設定信号Ｃに基づいて、拡散信号を増幅する。

【００９５】ここで、各々の階層に品質差をつけるため、レベル設定信号Ａ、レベル設定信号Ｂ及びレベル設定信号Ｃは、それぞれ異なるレベルを指定する。なお、拡散符号Ａ、拡散符号Ｂ、拡散符号Ｃは、互いに直交性を有する。

【００９６】各拡散器から出力された拡散信号は、加算器６０４にて加算された後、変調器６０５にて変調され、階層変調出力として階層変調器１０３から出力される。

【００９７】逆拡散器６５１は、入力した信号に対し、拡散器６０１の拡散処理に用いたと同じ拡散符号Ａで逆拡散を行い、階層１に振り分けられたセルを取り出す。ＲＡＫＥ合成器６５４は、逆拡散器６５１から出力されたセルをＲＡＫＥ合成する。

【００９８】同様に、逆拡散器６５２は、入力した信号に対し、拡散器６０２の拡散処理に用いたと同じ拡散符号Ｂで逆拡散を行い、階層２に振り分けられたセルを取り出す。ＲＡＫＥ合成器６５５は、逆拡散器６５２から出力されたセルをＲＡＫＥ合成する。

【００９９】また、逆拡散器６５３は、入力した信号に対し、拡散器６０３の拡散処理に用いたと同じ拡散符号Ｃで逆拡散を行い、階層３に振り分けられたセルを取り出す。ＲＡＫＥ合成器６５６は、逆拡散器６５３から出力されたセルをＲＡＫＥ合成する。

【０１００】これにより、ＣＤＭＡ方式の無線通信システムにおいて、送信側と受信側との間でレート選択情報を受け渡しすることなく回線状況にあわせて自動的にデータ伝送レートを切替えることができる。

【０１０１】（実施の形態４）図７は、本発明の実施の形態４における無線通信装置の部分構成を示すブロック図である。図７（ａ）は、無線通信装置の階層変調器の構成を示し、図７（ｂ）は、無線通信装置の階層復調器の構成を示す。

【０１０２】図７（ａ）に示す階層変調器１０３は、各々異なるサブキャリアを用いて変調する複数の変調器７０１、７０２、７０３と、各変調器から出力された変調信号を加算する加算器７０４とを具備する。

【０１０３】また、図７（ｂ）に示す階層復調器１２３は、復調処理を行う複数の復調器７５１、７５２、７５３を具備する。

【０１０４】変調器７０１は、階層１に振り分けられたセルに対してサブキャリアＡを用いて変調処理を行い、レベル設定信号Ａに基づいて、変調された信号を増幅する。同様に、変調器７０２は、階層２に振り分けられたセルに対してサブキャリアＢを用いて変調処理を行い、レベル設定信号Ｂに基づいて、変調された信号を増幅する。また、変調器７０３は、階層３に振り分けられたセルに対してサブキャリアＣを用いて変調処理を行い、レベル設定信号Ｃに基づいて、変調された信号を増幅する。

【０１０５】ここで、各々の階層に品質差をつけるため、レベル設定信号Ａ、レベル設定信号Ｂ及びレベル設定信号Ｃは、それぞれ異なるレベルを指定する。なお、マルチキャリア伝送を行うため、サブキャリアＡ、サブキャリアＢ及びサブキャリアＣは、互いに直交性を保つように、異なるサブキャリアを指定する。

【０１０６】各変調器から出力された信号は、加算器７０４にて加算され、階層変調出力として階層変調器１０３から出力される。

【０１０７】復調器７５１は、入力した信号に対し、変調器７０１の変調処理と同じサブキャリアＡで復調処理を行い、階層１に振り分けられたセルを取り出す。同様に、復調器７５２は、入力した信号に対し、変調器７０２の変調処理と同じサブキャリアＢで復調処理を行い、階層２に振り分けられたセルを取り出す。また、復調器７５３は、入力した信号に対し、変調器７０３の変調処理と同じサブキャリアＣで復調処理を行い、階層３に振り分けられたセルを取り出す。

【０１０８】これにより、マルチキャリア方式の無線通信システムにおいて、送信側と受信側との間でレート選択情報を受け渡しすることなく回線状況にあわせて自動的にデータ伝送レートを切替えることができる。また、

各周波数に直交関係を持たせることにより、マルチキャリア方式の一種であるＯＦＤＭにて無線通信を行うことができる。

【０１０９】（実施の形態５）図８は、本発明の実施の形態５における無線通信装置の部分構成を示すブロック図である。図８（ａ）は、無線通信装置の階層変調器の構成を示し、図８（ｂ）は、無線通信装置の階層復調器の構成を示す。

【０１１０】図８（ａ）に示す階層変調器１０３は、各々異なるマッピング処理を行う複数のマッピング器８０１、８０２、８０３と、各マッピング器の出力タイミングを調整する接続スイッチ８０４、８０５、８０６と、マッピングされた信号を加算する加算器８０７と、加算された信号を変調する変調器８０８とを具備する。

【０１１１】また、図８（ｂ）に示す階層復調器１２３は、復調処理を行う複数の復調器８５１、８５２、８５３を具備する。

【０１１２】マッピング器８０１は、階層１に振り分けられたセルに対してＢＰＳＫ変調によるマッピングを行う。同様に、マッピング器８０２は、階層２に振り分けられたセルに対してＱＰＳＫ変調によるマッピングを行う。また、マッピング器８０３は、階層３に振り分けられたセルに対してサブキャリアＣを用いてマッピングを行う。

【０１１３】各マッピング器の出力は、タイミング信号Ａ、タイミング信号Ｂ及びタイミング信号Ｃの接続スイッチ８０４、８０５、８０６に対する制御により、異なる時間に加算器８０７に出力され、加算器８０７にて加算された後、変調器８０８にて変調され、階層変調出力として階層変調器１０３から出力される。

【０１１４】このように、マッピングが異なる信号を異なる時間に出力することにより、時間によって品質が異なる信号を送信できる。

【０１１５】復調器８５１は、入力した信号に対し、タイミング信号Ａを用いて復調処理を行い、階層１に振り分けられたセルを取り出す。同様に、復調器８５２は、入力した信号に対し、タイミング信号Ｂを用いて復調処理を行い、階層２に振り分けられたセルを取り出す。また、復調器８５３は、入力した信号に対し、タイミング信号Ｃを用いて復調処理を行い、階層３に振り分けられたセルを取り出す。

【０１１６】これにより、ＴＤＭＡ方式の無線通信装置において、送信側と受信側との間でレート選択情報を受け渡しすることなく回線状況にあわせて自動的にデータ伝送レートを切替えることができる。

【０１１７】（実施の形態６）図９は、本発明の実施の形態６における無線通信装置の部分構成を示すブロック図である。図９（ａ）は、無線通信装置の階層変調器の構成を示し、図９（ｂ）は、無線通信装置の階層復調器の構成を示す。

【０１１８】図９（ａ）に示す階層変調器１０３は、拡散処理を行う複数の拡散器９０１、９０２、９０３と、各拡散器の出力タイミングを調整する接続スイッチ９０４、９０５、９０６と、各拡散信号を加算する加算器９０７と、加算された拡散信号を変調する変調器９０８とを具備する。

【０１１９】また、図９（ｂ）に示す階層復調器１２３は、逆拡散処理を行う複数の逆拡散器９５１、９５２、９５３と各逆拡散器の出力をＲＡＫＥ合成するＲＡＫＥ受信器９５４、９５５、９５６を具備する。

【０１２０】拡散器９０１は、階層１に振り分けられたセルに対して拡散符号Ａを用いて拡散処理を行い、レベル設定信号Ａに基づいて拡散信号を増幅する。同様に、拡散器９０２は、階層２に振り分けられたセルに対して拡散符号Ｂを用いて拡散処理を行い、レベル設定信号Ｂに基づいて拡散信号を増幅する。また、拡散器９０３は、階層３に振り分けられたセルに対して拡散符号Ｃを用いて拡散処理を行い、レベル設定信号Ｃに基づいて、拡散信号を増幅する。

【０１２１】ここで、各々の階層に品質差をつけるため、拡散符号Ａ、拡散符号Ｂ、拡散符号Ｃは、それぞれ異なる拡散率を有する。また、各々の階層に品質差をつけるため、レベル設定信号Ａ、レベル設定信号Ｂ及びレベル設定信号Ｃは、それぞれ異なるレベルを指定することを併用してもよい。全ての送信レベルを一定とすれば、拡散率が大きい信号程品質が良い。

【０１２２】各拡散器から出力された拡散信号は、タイミング信号Ａ、タイミング信号Ｂ及びタイミング信号Ｃの接続スイッチ９０４、９０５、９０６に対する制御により、異なる時間に加算器に出力され、加算器９０７にて加算された後、変調器９０８にて変調され、階層変調出力として階層変調器１０３から出力される。

【０１２３】このように、拡散率が異なる信号を異なる時間に出力することにより、時間によって品質が異なる信号を送信できる。

【０１２４】逆拡散器９５１は、入力した信号に対し、拡散器９０１の拡散処理に用いたと同じ拡散符号Ａで逆拡散を行い、階層１に振り分けられたセルを取り出す。ＲＡＫＥ合成器９５４は、逆拡散器９５１から出力されたセルをＲＡＫＥ合成する。同様に、逆拡散器９５２は、入力した信号に対し、拡散器９０２の拡散処理に用いたと同じ拡散符号Ｂで逆拡散を行い、階層２に振り分けられたセルを取り出す。ＲＡＫＥ合成器９５５は、逆拡散器９５２から出力されたセルをＲＡＫＥ合成する。また、逆拡散器９５３は、入力した信号に対し、拡散器９０３の拡散処理に用いたと同じ拡散符号Ｃで逆拡散を行い、階層３に振り分けられたセルを取り出す。ＲＡＫＥ合成器９５６は、逆拡散器９５３から出力されたセルをＲＡＫＥ合成する。

【０１２５】これにより、ＣＤＭＡ方式の無線通信シス

テムにおいて、送信側と受信側との間でレート選択情報を受け渡しすることなく回線状況にあわせて自動的にデータ伝送レートを切替えることができる導入できる。

【０１２６】

【発明の効果】以上説明したように、本発明の送信装置並びに受信装置及びデータ伝送方法によれば、送信側にて、送信信号をセル単位で複数の階層に振り分け、階層毎に誤り検出できる符号化を施し、階層変調して送信し、受信側にて、階層毎に復調して誤り検出を行い、階層毎に再送要求を行うことにより、装置間でレート選択情報の受け渡しを行うことなく、回線の状況に応じて自動的にデータ伝送レートを変更できる。これにより、制御信号の誤りによる誤動作を避けることができ、高速フェージング時でも対応でき、受信品質の推定精度を考慮する必要がない。

【図面の簡単な説明】

【図１】本発明の実施の形態１における無線通信装置の構成を示すブロック図

【図２】ＱＰＳＫ変調における階層変調の信号点配置を示す模式図

【図３】実施の形態２における無線通信装置の構成を示すブロック図

【図４】実施の形態２における無線通信装置の送信制御器の処理動作を示すフロー図

【図５】実施の形態２における無線通信装置の各階層のＴＭＰバッファに書き込まれるセルを表した模式図

【図６】実施の形態３における無線通信装置の部分構成＊を示すブロック図

【図７】実施の形態４における無線通信装置の部分構成を示すブロック図

【図８】実施の形態５における無線通信装置の部分構成を示すブロック図

【図９】実施の形態６における無線通信装置の部分構成を示すブロック図

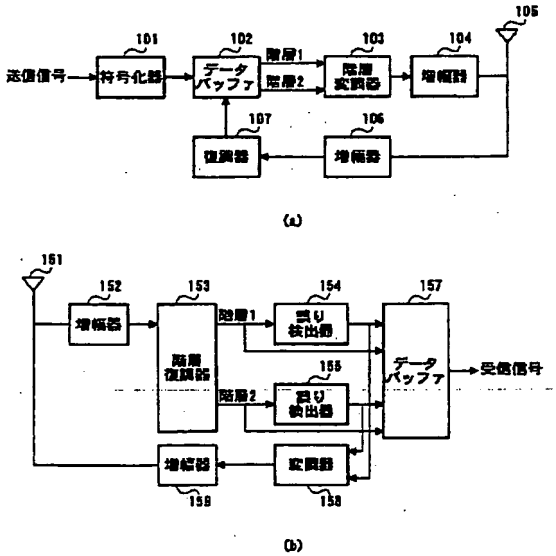
【図１０】従来のＴＤＤ伝送における適応変調を行う無線通信装置の構成を示すブロック図

【図１１】従来のＦＤＤ伝送における適応変調を行う無線通信装置の構成を示すブロック図

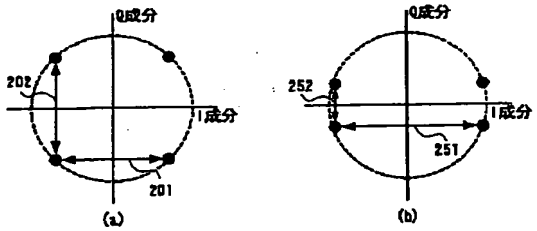
【符号の説明】

１０１　符号化器
１０２　データバッファ
１０３　階層変調器
１０４　増幅器
１０６　増幅器
１０７　復調器
１５２　増幅器
１５３　階層復調器
１５４、１５５、１５６　誤り検出器
１５７　データバッファ
１５８　変調器
１５９　増幅器
３０１　送信制御器
３０２、３０３、３０４　ＴＭＰバッファ

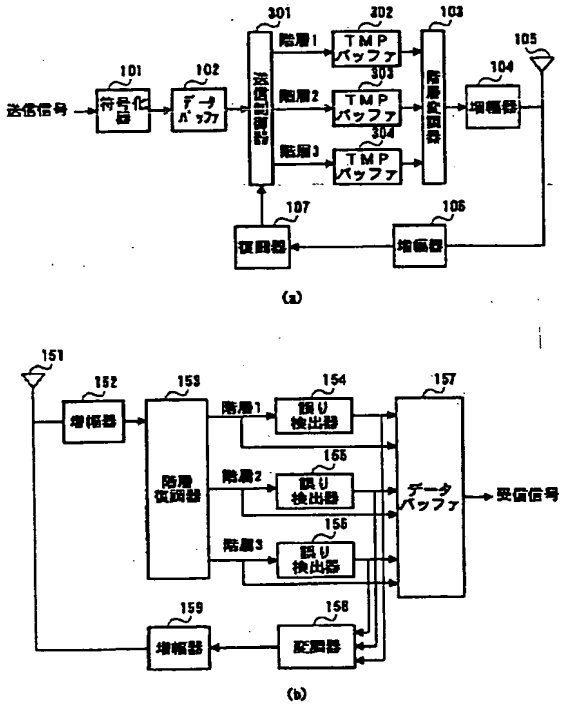
【図１】



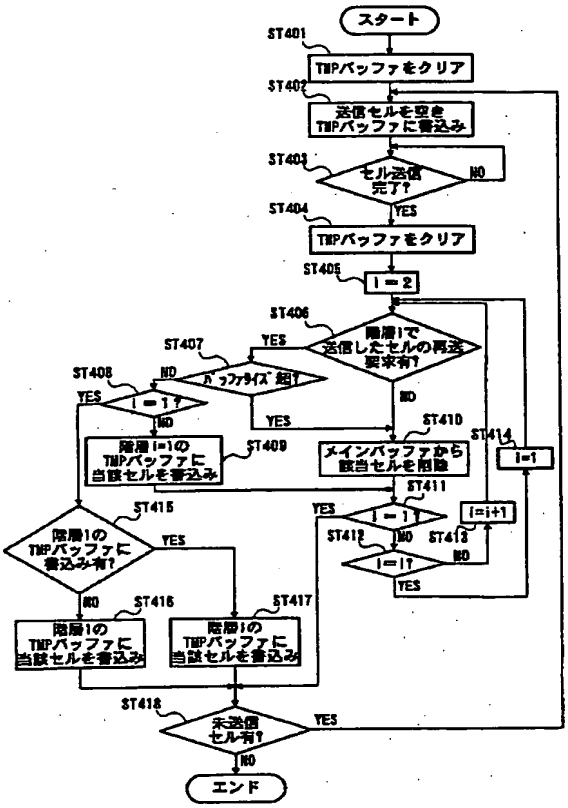
【図２】



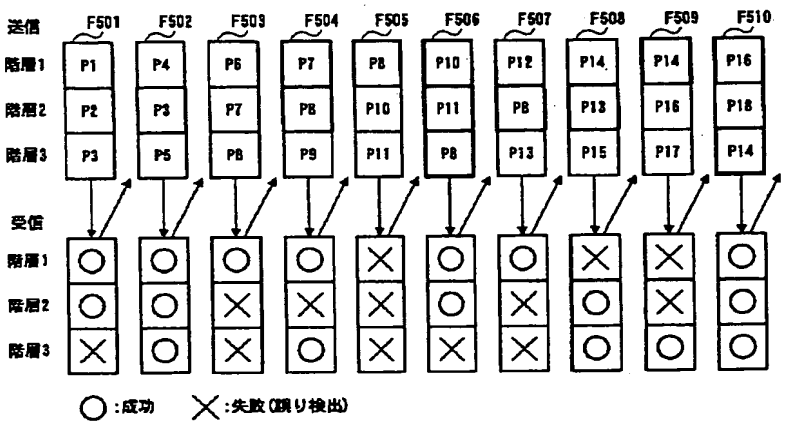
【図３】


送信信号
符号化器
データバッファ
送信制御器
階層1
階層2
階層3
TMPバッファ
階層変調器
増幅器
復調器
(a)
増幅器
階層復調器
誤り検出器
データバッファ
受信信号
復調器
(b)

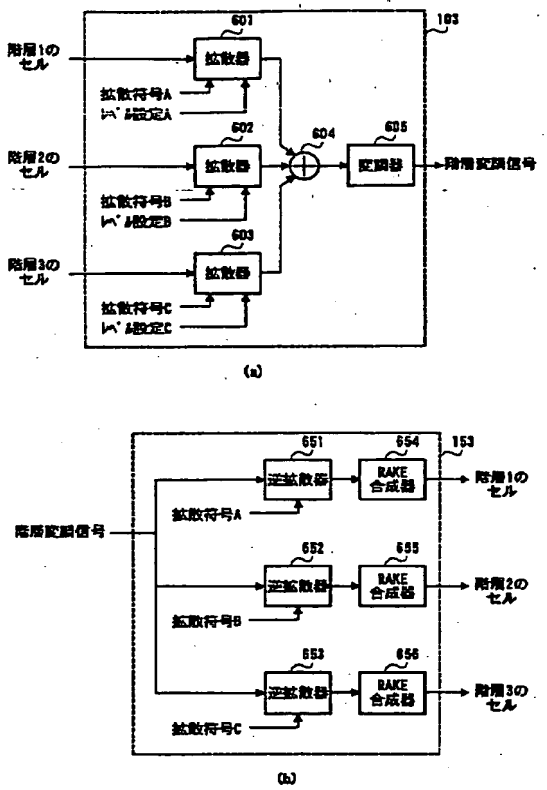
【図４】


スタート
TMPバッファをクリア
送信セルを空きTMPバッファに書込み
セル送信完了?
TMPバッファをクリア
i＝2
階層iで送信したセルの再送要求有?
バッファタイズ超?
i＝1?
階層i=1のTMPバッファに当該セルを書込み
メインバッファから該当セルを削除
i=1
i=i+1
階層1のTMPバッファに書込み有?
階層1のTMPバッファに当該セルを書込み
未送信セル有?
エンド

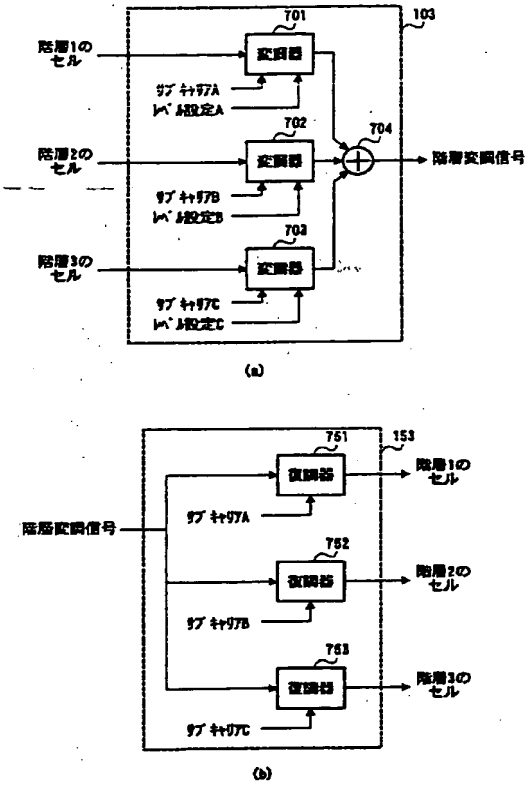
【図５】


送信
受信
階層1
階層2
階層3
○:成功
×:失敗(誤り検出)

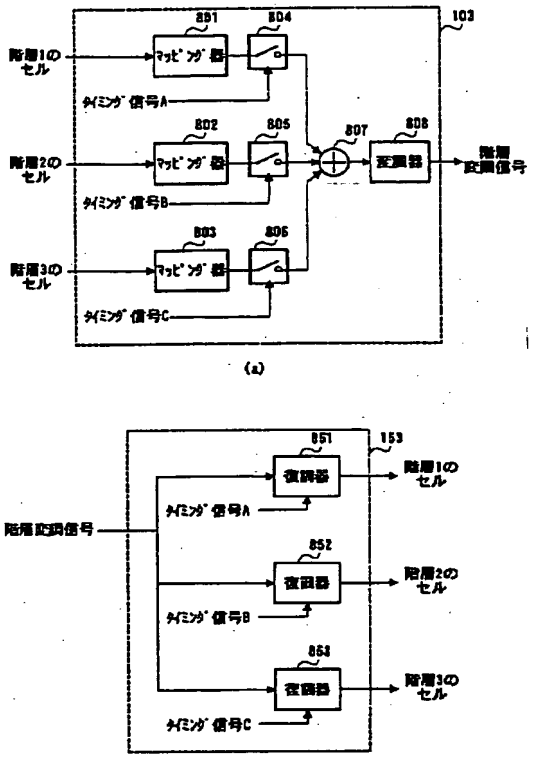
【図６】


601
拡散器
拡散符号A
レベル設定A
602
拡散器
拡散符号B
レベル設定B
603
拡散器
拡散符号C
レベル設定C
604
605
変調器
103
階層1のセル
階層2のセル
階層3のセル
階層変調信号
(a)
651
逆拡散器
654
RAKE合成器
153
652
逆拡散器
655
RAKE合成器
653
逆拡散器
656
RAKE合成器
階層変調信号
拡散符号A
拡散符号B
拡散符号C
階層1のセル
階層2のセル
階層3のセル
(b)

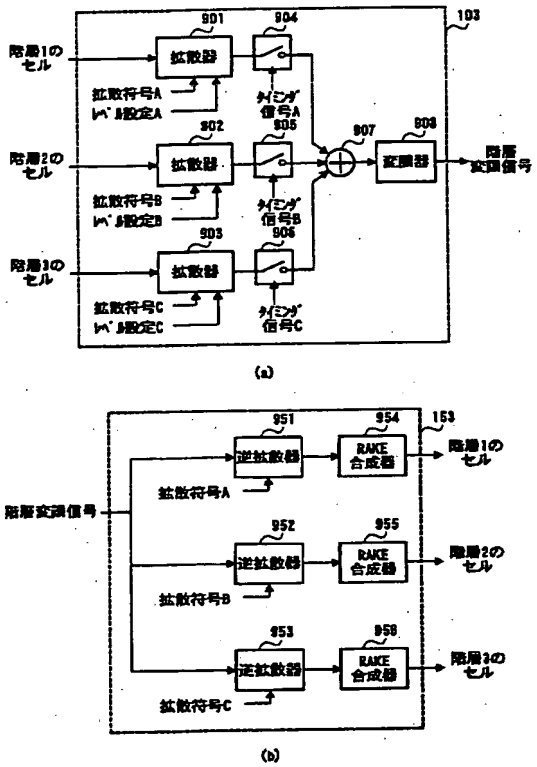
【図７】


701
変調器
サブキャリアA
レベル設定A
702
変調器
サブキャリアB
レベル設定B
703
変調器
サブキャリアC
レベル設定C
704
103
階層1のセル
階層2のセル
階層3のセル
階層変調信号
(a)
751
復調器
752
復調器
753
復調器
153
サブキャリアA
サブキャリアB
サブキャリアC
階層1のセル
階層2のセル
階層3のセル
階層変調信号
(b)

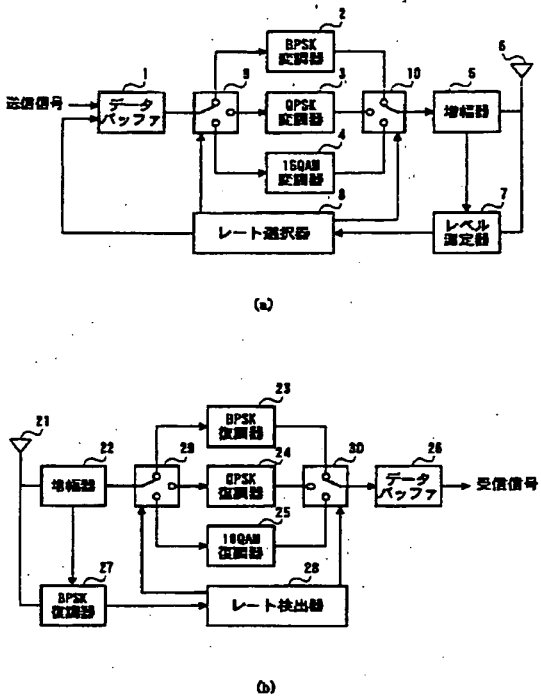
【図８】


103
801
804
マッピング器
階層1のセル
タイミング信号A
802
805
マッピング器
階層2のセル
タイミング信号B
807
808
変調器
階層変調信号
803
806
マッピング器
階層3のセル
タイミング信号C
(a)
153
851
復調器
階層1のセル
タイミング信号A
852
復調器
階層2のセル
タイミング信号B
853
復調器
階層3のセル
タイミング信号C
階層変調信号
(b)

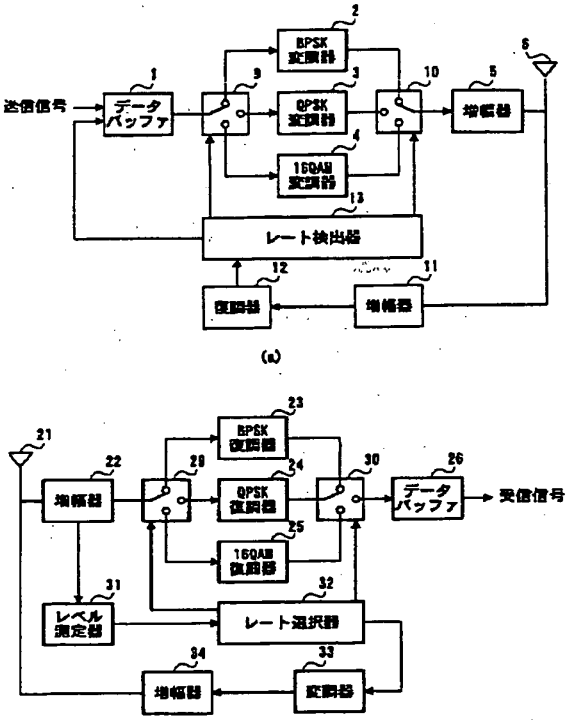
【図９】


103
901
904
拡散器
階層1のセル
拡散符号A
レベル設定A
タイミング信号A
902
905
拡散器
階層2のセル
拡散符号B
レベル設定B
タイミング信号B
907
908
変調器
階層変調信号
903
906
拡散器
階層3のセル
拡散符号C
レベル設定C
タイミング信号C
(a)
153
951
954
逆拡散器
RAKE合成器
階層1のセル
拡散符号A
952
955
逆拡散器
RAKE合成器
階層2のセル
拡散符号B
953
956
逆拡散器
RAKE合成器
階層3のセル
拡散符号C
階層変調信号
(b)

【図１０】


送信信号
データバッファ
BPSK変調器
QPSK変調器
16QAM変調器
増幅器
レート選択器
レベル測定器
(a)
受信信号
データバッファ
BPSK復調器
QPSK復調器
16QAM復調器
増幅器
レート検出器
(b)

【図１１】


送信信号
データバッファ
BPSK変調器
QPSK変調器
16QAM変調器
増幅器
レート検出器
復調器
(a)
受信信号
データバッファ
BPSK復調器
QPSK復調器
16QAM復調器
増幅器
レベル測定器
レート選択器
(b)